MODERN
Machine Shop
January, 1938

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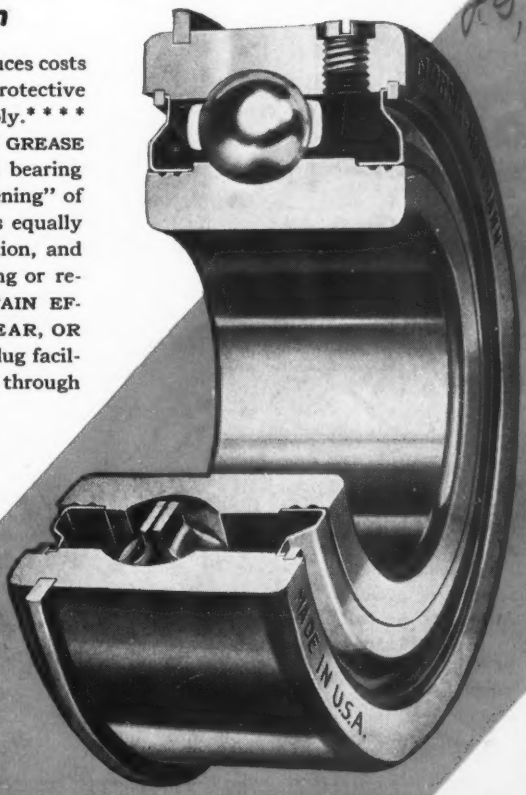

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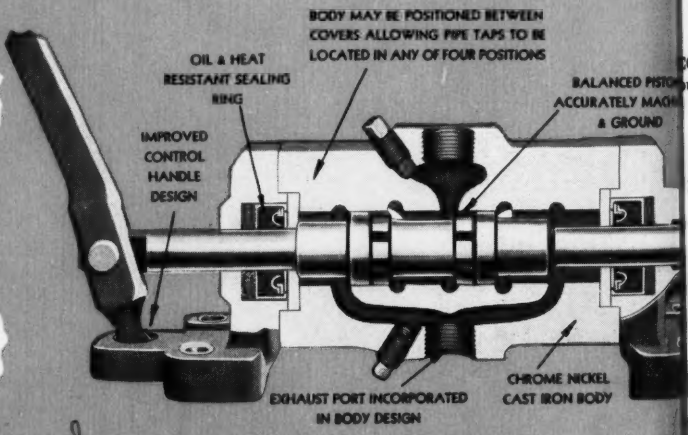
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HOWARD CAMPBELL, Editor

Volume 10 JANUARY, 1938 Number 8

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MODERN Machine Shop

CINCINNATI, OHIO

JANUARY, 1938 VOL. 10, NO. 8

A. C. L. Shops at Tampa are Well Equipped

By HOWARD CAMPBELL

THE Tampa Shops of the Atlantic Coast Line Railroad are among the finest in the United States, considering size, construction, and general plant layout. The longitudinal method is used in this shop for handling engines, boilers, tanks, engine parts, and supplies both inside and outside of the shop. Three lines of track are provided in the center bay for handling the engines.

Before entering the shop, the engines are stripped of all parts requiring lye vat cleaning and then further stripped of motion work, rods, wheels, boxes, and other parts, even to removing the boilers from the frames as each engine progresses from station to station, depending on the nature and extent of the repairs required. After repairs have been made, the engine retraces its path toward the same end of the shop through which it entered, and is moved to one of the finishing tracks. Here the parts are reassembled to the engine and it is again ready for service.

The handling of parts through the

Machine Shop, A.C.L. Shops, Tampa, Florida, from one end.

shop is based on the "unit" system, the machine shop equipment being segregated by departments, as far as possible, so that any major part can be completely processed in a single department. The handling of parts back and forth across the shop is practically eliminated and the fact that all work of a given nature is handled in a single department eliminates a great deal of follow-up, pencil work, tickets and records and other expenses of a non-productive nature.

To operate on the unit system, the machine shop is divided into definite work units or departments, each unit being supplied with sufficient equipment for its own job. The Tampa shop has been laid out for 30 engines per month, but in arranging the equipment in the individual units enough space was provided so that extra equipment could be set in to bring the productive capacity up to 45 engines per month.

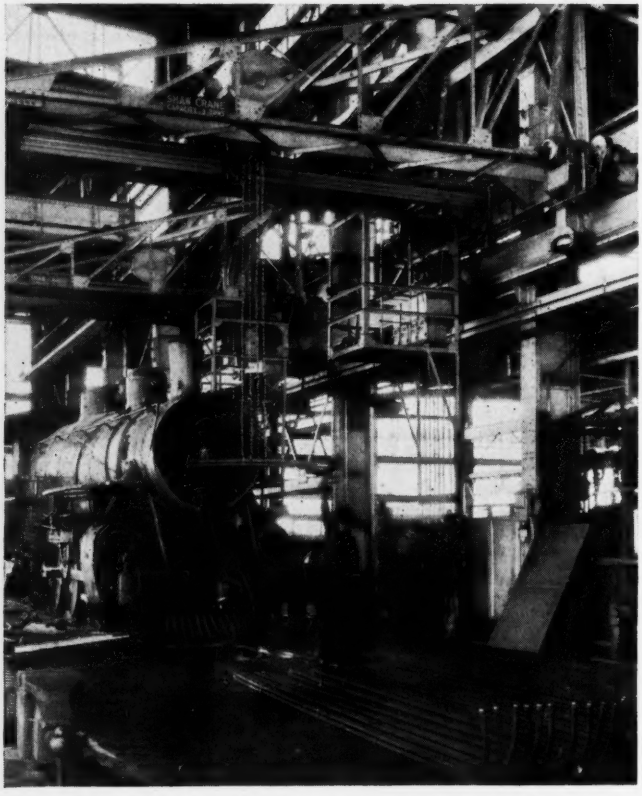


Fig. 1—A Shaw jib-type side wall 3-ton crane, equipped with floor controls, is used to aid in inserting superheater flues.

As an example, the driving box and shoe and wedge unit is equipped with two 36-in. draw-cut shapers, one 8-in. Monarch engine lathe, one 30-in. draw-cut shaper with special crown bearing jig, one vertical drill press of a size that will handle all the work, one 42-in. Bullard vertical turret lathe, and one 100-ton Chambersburg bushing press. Two jib swing cranes, each equipped with a ½-ton Shepard electric hoist, are provided to handle the work of the machines. These cranes are designed to swing through 270 deg., and are located so that every machine in the unit is served.

Driving boxes that are to be reconditioned are brought in from the cleaning vats and placed under the No. 1 crane in the driving box unit.

Fig. 2—With the tool shown in this illustration, threads on a pump piston rod can be accurately rechased although the center hole in the rod may be battered.

Here the dowels are knocked out and the crown bearings are then pressed out. New crown bearings are fitted on the draw-cut shaper and are then pressed in. New dowel holes are drilled in the bearings, the boxes are planed in the 36-in. draw-cut shaper, and are passed to the boring mill where they are bored. From the boring mill they are set back on the floor and the cellars are fitted, which is the last operation before they are fitted to the journals.

The second 36-in. draw-cut shaper is used to plane the shoes and wedges, and is especially equipped with jigs for planing the back and main rod brasses, driving box bearing fits, and new crossheads. In this unit, at the present time, two mechanics handle all of the work for an output of seven engines per month, aided by one helper for about one-third of the time.

All work on pistons and valves is handled in one unit, rods in another, valve gears in another, and so on. The track that extends through the shop is marked off into sections and each section is numbered. As each engine is brought into the shop to be overhauled, it is placed on a "spot" in one of these sections. Then, as the engine is dismantled, tags bearing the job number of the engine and

Fig. 3—With this homemade indicating gage the mechanic can tell to just what extent the piston rod is worn.

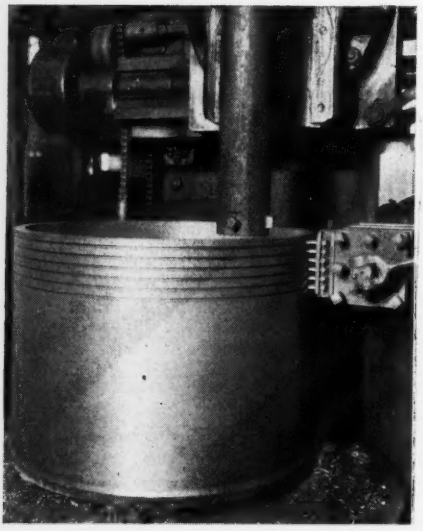


Fig. 4—Six packing rings are cut off almost simultaneously with this multiple parting tool.

the number of the spot upon which it has been placed are attached to the individual parts. Thus it will be a very simple matter to return the parts to the proper engine.

The erecting shop is equipped with two 100-ton cranes and also four 3-ton jib-type side wall cranes, two on each side. In Fig. 1 one of the side wall cranes is shown in use for inserting superheater units into a locomotive boiler. The crane is equipped with controls which can be operated from the floor, thus making it possible for the boilermakers to operate the crane to the best advantage. The units are lifted to the exact height required and entered into the boiler flues by simply moving the crane. A crane of this type is a great help on such work.

A simple but very useful piece of equipment is shown in use in Fig. 2. When the piston is removed from an air cylinder and the head is taken off, it so happens that frequently the threads are damaged, necessitating rechasing with a single point tool. If the center hole in the end of the rod is also damaged, quite a bit of time is lost in recentering accurately and sometimes the task is practically impossible.

The tool shown consists of a cylindrical piece with a fairly large center hole in one end and with the other

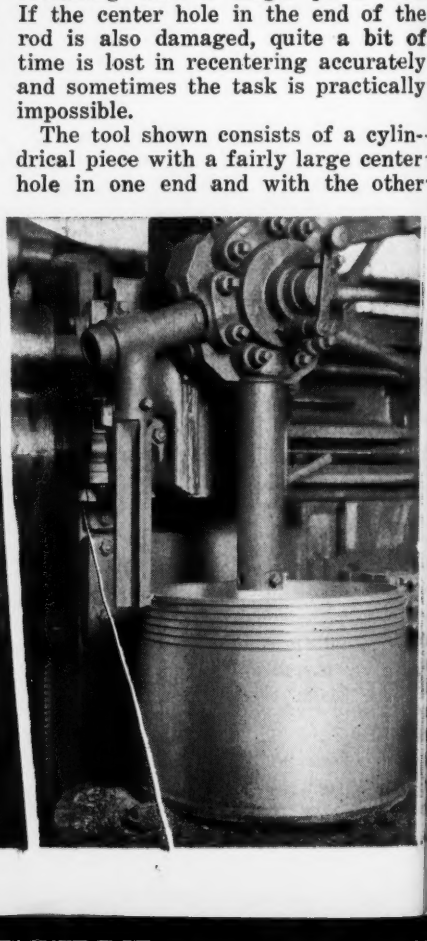


Fig. 5 — Packing rings of ¾-in. size are chamfered and oil grooved with this tool. Inasmuch as hand feed is necessary, a sleeve with a hexagon end for a ratchet and a set screw for locking in place is provided for the feed rod.

end serving as a raceway for a part which contains a tapered hole to fit the taper on the end of the piston rod. Raceways are cut in the two contacting parts and balls are used so that the end piece with the tapered hole is practically a ball thrust bearing. With this tool seated firmly on the taper of the piston rod, the rod can be swung between the centers of the lathe and the threaded end will run true with the taper on the shaft. The cylindrical part of the tool remains stationary while the contacting part and piston revolve, and inasmuch as an opening is cut in the side of the cylinder, as shown, a lathe tool can be inserted far enough to recut the threads true with the shaft.

The operator shown in Fig. 3 is using a home-made tool to test the concentricity and diameter of a piston rod. The tool is simply a ring slightly larger than the diameter of the rod, to which a dial indicator has been attached in such manner that the plunger protrudes through a small hole in the ring. Thus as the ring is moved up and down and around on the rod, the indicator hand will give the operator the information he needs as to high and low spots, concentricity, taper, and so on.

The illustration Fig. 4 shows the tools used for cutting off piston rings from a cast iron piston ring pot. A Bullard vertical boring mill is used for the job, and the usual boring tool and side turning tools are used to bore and turn the pot. The feature of the job is the set of six parting tools by which six rings are cut off almost — but not quite — simultaneously. Beginning with the top ring, each ring in turn is cut off just ahead of the ring below it, so that it can easily be removed by the operator without spoilage. The tools are approximately 3/16 in. thick and the rings are ½ in. thick. There are 24 rings to a pot and from two to two and one-half pots can be machined with this equipment in eight hours.

When ¾-in. packing rings are cut on this vertical mill as described in the preceding paragraph, it is necessary to chamfer them, which is done with the tool shown in Fig. 5. This tool consists primarily of an arm carrying a toolbit, the arm being adjusted so that it extends downward as shown in the illustration. While the cutting off tools shown in Fig. 4 are

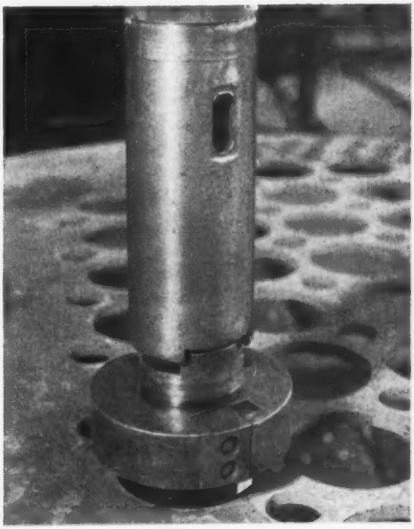


Fig. 6—Trepanning tool of excellent design.

in process, the edges of the rings are chamfered and the oil grooves are cut with the tool shown. Inasmuch as this tool must be operated from the feed controls, the tool is adjusted by means of a ratchet handle applied to the hexagon end of the feed rod.

A trepanning tool of unusually good design is shown in operation in Fig. 6. The outstanding feature of the tool is the fact that a wedge is used to hold the tool in position, eliminating the necessity for protruding setscrews. The slot for the wedge is first milled, then the square recess for the toolbit is cut in, this slot being

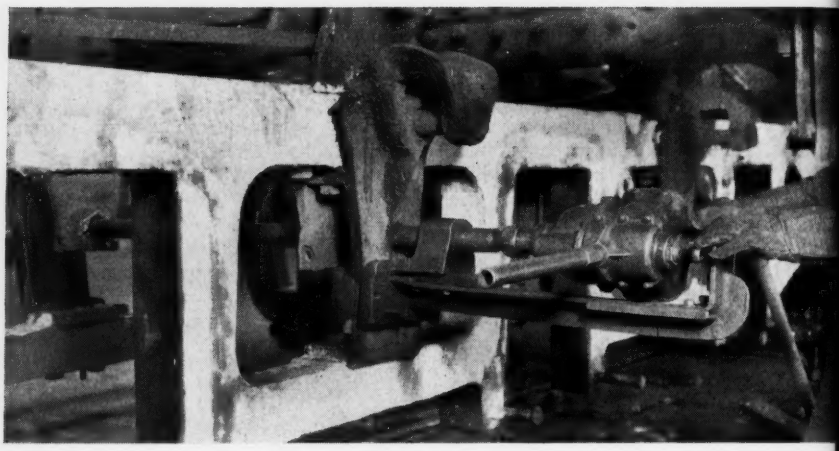


Fig. 7—With this boring outfit the four holes in the equalizer hangers can be rebored simultaneously and in exact alignment without removing the hangers from the locomotive frame.

left just shallow enough, however, so that the top surface of the toolbit protrudes slightly above the surface into which the toolbit is set. Then a wedge is made to fit the large slot and holes are drilled and counterbored in the wedge and drilled and tapped in the tool for two setscrews as shown.

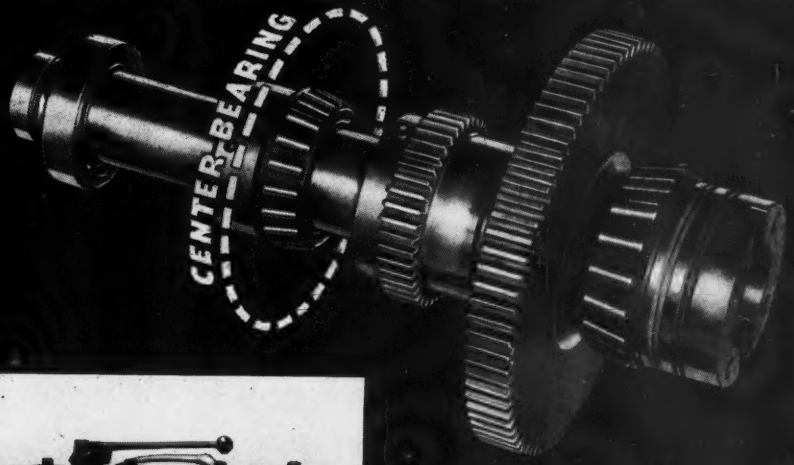
When the wedge is drawn down tight in the slot, it bears against the top surface of the toolbit and thus binds it in position. With this design, inasmuch as the toolbit is not held by the setscrews direct, the toolbit slot can be cut, if required, nearer the periphery of the tool. Thus a tool of this type not only has the advantage of safety, but it can be used to cut a larger hole than would be possible with the same tool by the older method. Tools of this type are used in this shop to cut holes as large as 10½ in. diameter.

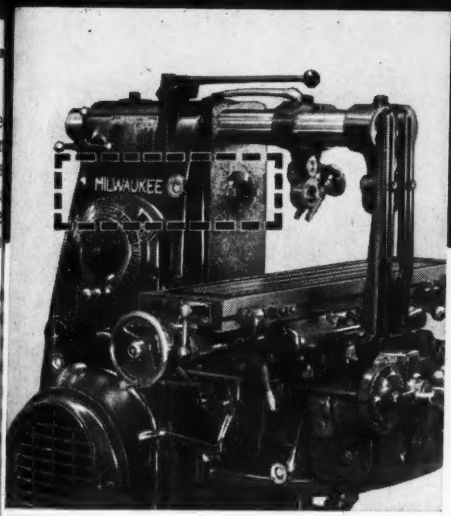
When equalizer hangers become badly worn, they are welded without removing them from the locomotive and are then rebored with the tool shown in Fig. 7. The tool consists of a boring bar which is held in position by two brackets that are clampe to the equalizer hangers as shown The holes in the brackets are jus large enough to provide a runnin fit for the boring bar and each bracke is clamped to the outside of th hanger.

To locate the bar properly, th holes in the brackets are centere with the bottoms of the holes in th hangers, which is usually possibl due to the fact that these holes wea principally at the top. With th brackets in position, the boring ba is inserted and four toolbits are locke in position in the bar. The toolbi holes are spaced properly so that a four holes in the hangers will be bore simultaneously and in exact alig ment. Power is supplied by an a motor, as shown. This tool makes unnecessary to remove the hange for welding and boring, and thu saves a considerable amount of tim

The illustration Fig. 8 is that of a oven which has been built up aroun a cracked cylinder so that the cyli der can be welded. The oven is co structed of fire-brick from the fi box of a locomotive, to which th

CENTER BEARING MAKES SPINDLE *8 times* STIFFER





Addition of a Center Bearing reduce by one-half the distance between bea ings and increases the rigidity 8 times – (shaft deflection varies as the cube o the distance between bearings) » »

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necessary amount of asbestos is added to make a practically air-tight oven.

When building the oven, bricks are left loose in the end and lower side so that a wood fire can be built inside the oven for preheating. A good fire should be built and the cylinder

Fig. 8—Welding a cracked cylinder. The cylinder is preheated, before welding, in an oven built of fire brick from the locomotive fire box.

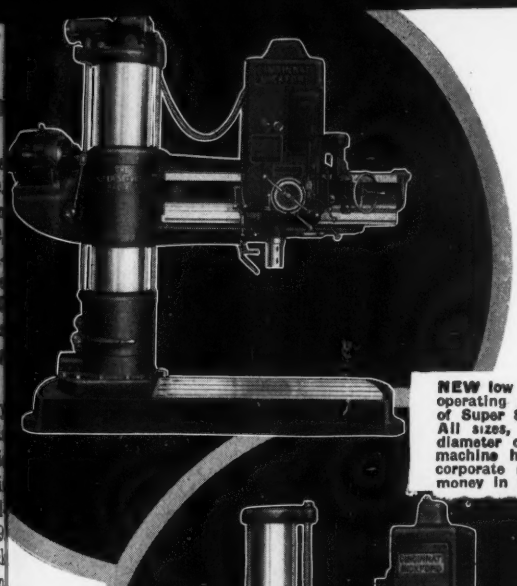
should be preheated for approximately two and one-half hours. After this time, the fire can be raked out through the side hole, which is then closed up with bricks. The operator welds the crack in the cylinder by inserting his torch through the end hole, as shown.

After welding, the brick wall should be left around the cylinder until the cylinder is almost cold on the outside. It should be remembered that when the cylinder has cooled on the outside it will still be quite warm on the inside. This cooling process will take approximately two days. A No. 2 Oxweld Manganese Bronze Rod is used for the welding operation.

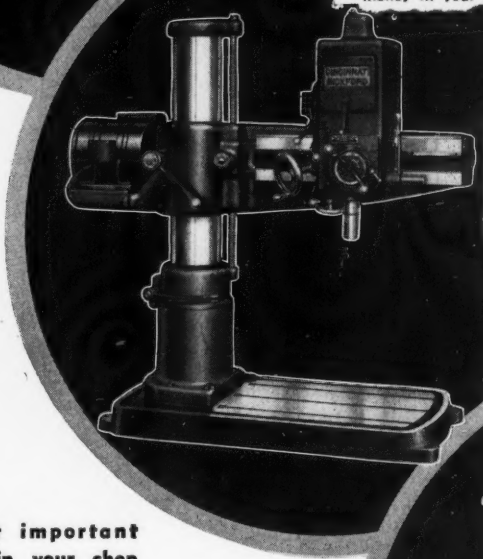
An exceedingly handy piece of equipment is found in the hydraulic rack for handling air pumps while overhauling, shown in Fig. 9. The frame of the rack is made from ⅛ in. boiler plate, bolted and then welded. The base to which the pump is bolted consists of a center beam, turned to provide journals at each end, to which are bolted two cross arms. Holes are provided in these cross arms for bolting the pump in position. To one end of one of the cross arms is attached one end of the piston rod of the hydraulic cylinder. As oil is pumped into the cylinder the piston is forced upward and the base, carrying the pump, is swung into horizontal position. When the oil is by-passed, the piston retreats into the cylinder and the base swings to the vertical position.

Two check valves are used in the construction of the hydraulic pump, a ⅜-in. valve for the intake and 1-in. for the discharge. The by-pass is made from a needle valve from an air-operated fire door. The ball joint in the connection from the piston ro

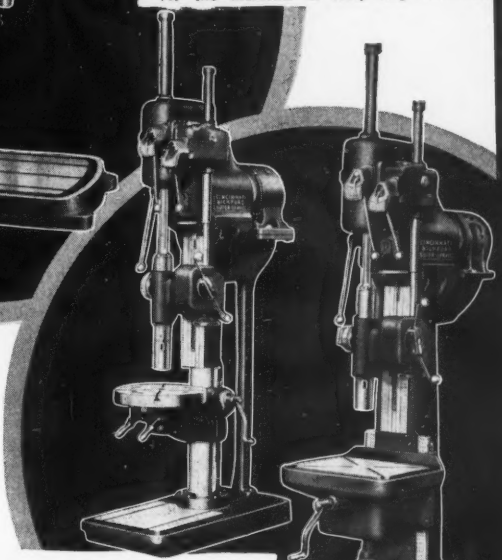
New Cost-Cutting Super Service Drilling Machines



NEW low controls centralized 100% at the operating position are featured on the line of Super Service Radials shown at the left. All sizes, from the 3' machine with 11" diameter column to the powerful 12' arm machine having 26" diameter column, incorporate new improvements that will save money in your drill department.



New High Speed 3' and 4' Super Service Radials will provide a speed range to suit your work no matter how small your drilling. All speeds and feeds changed by sliding gears with single lever control at the head. Balanced head and arm move on antifriction bearings for the ultimate in fast, easy handling.



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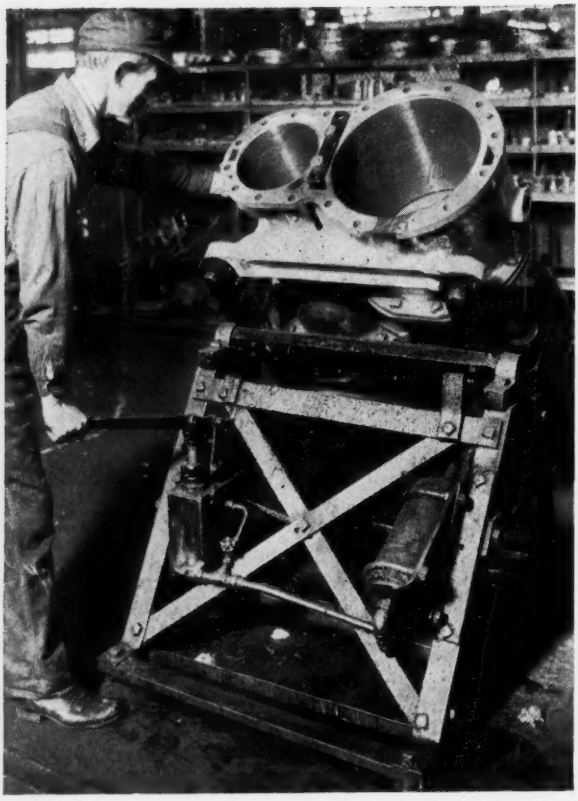

Fig. 9—Hydraulic rack for use in overhauling pumps.

to the base is made out of a push rod from a bell ringer. The hydraulic solution used is a mixture of kerosene and machine oil. The rack is comparatively simple to make and is as efficient as it is simple.

Stark Bulletin J, devoted to the Stark Integral Drive Precision Bench Lathe, is an attractive six-page folder, printed in color. The principles of construction and operation of the lathe are fully explained, and action photographs aid in presenting the features of the machine. Specifications are included. A copy of the bulletin is available without charge to any mechanical executive upon application to the Stark Tool Company, Waltham, Massachusetts.

Geometric No. 14 Preci sion Threading Machine product of The Geomet ric Tool Company, Ne Haven, Conn., is the sub ject of a four-page folde now being distribute by that firm. The ad vantages of the machin are enumerated an views of the variou parts of the machin are included. One pag of the folder is devote to a labeled drawin which shows not on the main features of th No. 14 Precision Thread ing Machines, but whic may also be used as guide in making adjus ments or as a chart f ordering repairs. Specifi cations are include Copy free upon reques

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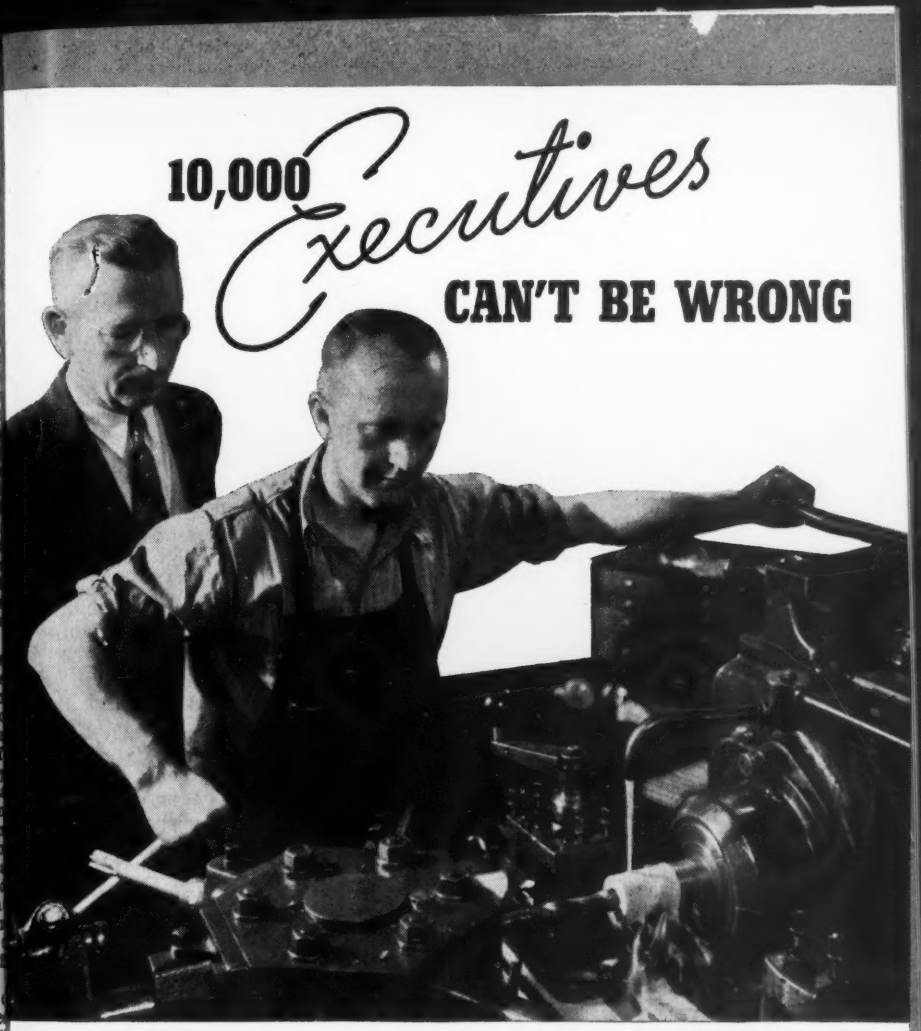
Vanadium in Ca Iron, a 28-page bookl just issued by the Va adium Corporation America, 420 Lexingto Ave., New York, N. describes improved ph sical properties of ca irons employing varyi amounts of vanadiu Numerous charts a tables list the specific tions of various vana ium-containing iron and a number of co mercial applications vanadium irons are lustrated.

Microstructure and macrostructure vanadium alloy cast irons are discusse as compared with the structure of ord nary cast iron. Comparative data a given on the tensile strength; Brine hardness; transverse strength and du tility; compressive strength; resistan to impact; machinability; wear resis ance; growth and distortion; and r sponse to heat treatment.

Tables show recommended compos tion of plain and complex vanadiu irons for numerous applications, inclu ing locomotive cylinders, bottle mold Diesel engine heads, gears, brake drum flywheels and steel mill rolls.

Compositions of established use a discussed, among which are nickel-va adium iron, nickel-chromium-vanadiu iron, nickel-molybdenum-vanadium ir titanium-vanadium iron and chromiu vanadium iron. Copy free upon reque



THE thousands of business firms who cut costs in the past year with new Warner & Swasey turret lathes and tools would read like a Blue Book of American Industry. The men who decided on these purchases probably totaled 10,000 of the keenest, most analytical and far-sighted executives in the country. They are men who invest only when it can be *proven* to them that the investment will result in lower costs, higher profits. That is exactly the kind of proof that can be demonstrated about the new, faster, more accurate, easier-to-operate Warner & Swasey Turret Lathes. May we demonstrate what these improved machines would do in your shop—and for your net profit?

ou can turn it better, faster, for less —with a Warner & Swasey.

WARNER & SWASEY
Turret Lathes
Cleveland

A Study of Vibration and Sound

By E. V. SUNDT,
General Manager, Sundt Engineering Company, Chicago, Ill.

IT seems, on looking back over the last ten years, that an increasing interest on the part of engineers, designers and production men in vibration and noise reduction has paralleled improved machinery standards, higher speeds and efficiency. To prove this statement, compare 1937 trains, automobiles, washing machines — yes, even shop tools — with the vintage of 1927. There has been a definite move toward quieter, smoother operation, not only of machinery, but in industrial operations. While the effect of noise on human efficiency is a subject that is receiving more and more attention, because of its recognized importance, it is hardly beyond question that noise reduction is now a definite public trend.

After all, noise is usually caused by vibrations due to imperfect design or workmanship and results in energy loss and often in structural failure. If I may digress from the industrial to the philosophical for a moment, there seem to be trends or currents of public demand in all walks of life be it industrial, social, political, or economic. The industry or man who rides abreast of these currents is wise; if he can foresee them, he is a genius. Public demand (much more so than corporations) has no soul.

It is much beyond the scope of this article to adequately cover the subject of noise reduction. What we will try to do, however, is to outline a practical, usable method of measuring and analyzing its illegitimate father; vibration. With this end in view, we will first discuss the principle factors of vibration, then the methods used in studying and analyzing it and, third, some industrial application of such a study.

A vibration study considers four principal factors; frequency, amplitude, vibration velocity and vibration wave form. The frequency of vibration is

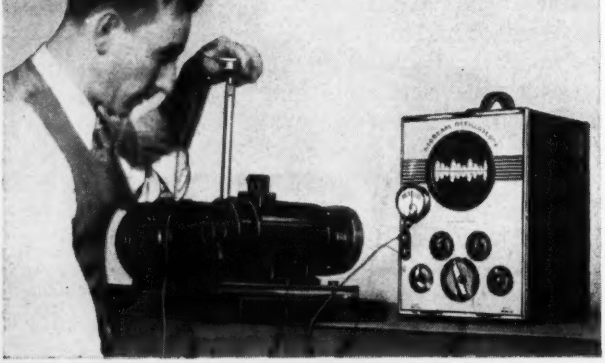


Fig. 1—Neobeam Oscilloscope used in making the tests described in this article.

generally expressed in terms of complete cycles per second. Usually a mechanical body does not vibrate at one simple frequency but as a result of two or more frequencies. Some of the frequencies encounterd in machine practice are very low; about ten per second, and therefore are not important from the standpoint of noise production. It is not often that frequencies above 1,000 are encountered, but this value is, of course, dependent on the applied energy compared to the weight of the vibrating body.

Frequency is perhaps the most important factor in the study of vibration, since the vibration energy varies as the square of the frequency, provided the amplitude of vibration remains constant. In other words, twice the frequency, four times the energy; triple the frequency, nine times the energy, and so on. Any study of vibration must take this factor into consideration.

The amplitude of vibration is the factor of most general interest and is usually expressed in terms of thousandths of an inch of overall motion of vibration. This is the factor referred to in the question, "How much does it vibrate?" The range of amplitudes encountered in industrial vibration study is very great, but in general any vibration less than 0.0001 in. need hardly be considered except at very high frequencies, and vibrations up to ½ in. or more are encountered in aircraft applications. The vibration energy varies directly as the amplitude at constant frequency.

The velocity of vibration is a factor sometimes used in the study of vibrations and is the product of frequency and amplitude (F X A). It is usually expressed in terms of R.M.S. thousandths of an inch per second and represents for practical purposes the average rate at which a vibrating body moves per second. While this factor is seldom considered in practical work, it is usually considered in the theoretical and mathematical analysis of vibration where energy considerations are involved. As a general rule, in machinery the velocity of vibration tends to remain constant since the higher the frequency the lower the amplitude and vice versa. The product of the two tends to remain the same.

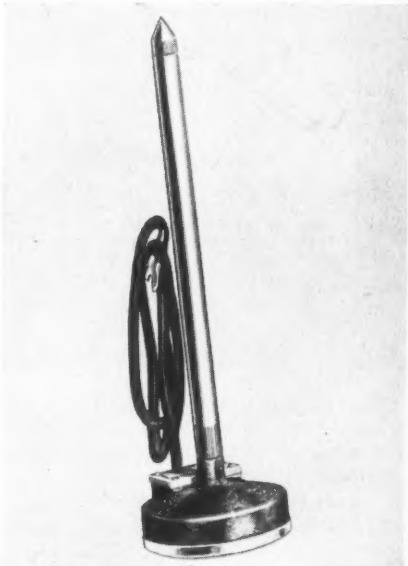


Fig. 2—"Vibration Pickup" which transmits the amount of vibration to the meter.

In the analysis of vibration the wave form of the motion is important. In machinery, especially when the weight is great compared to the vibration energy, the wave form is usually fairly sinusoidal. In a great many instances, however, this may not be true, as sheet metal vibrations for instance. Very often a body may vibrate at some fundamental frequency as well as at one or two high frequencies or harmonics at the same time. The resulting wave form in

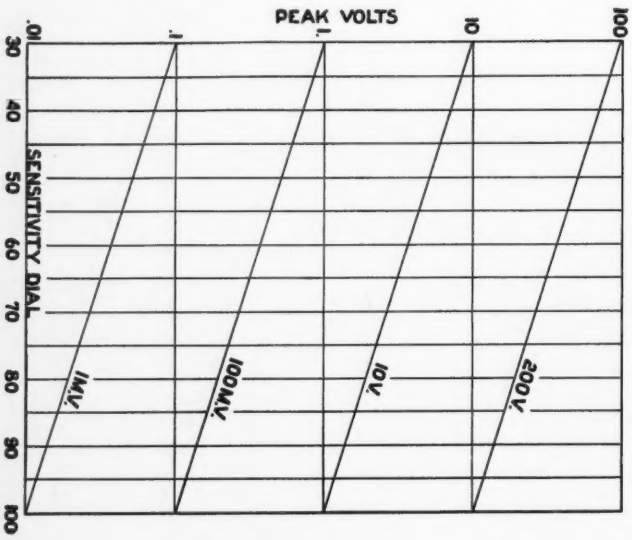


Fig. 3—Graph of Voltage-Sensitivity Curve

this case is often distorted. The analysis of such wave form is often very difficult, albeit desirable, and belongs in the laboratory rather than the shop.

One of the practical phases of vibration study is determining the plane and axis of vibration. Sometimes a machine vibrates in some parts much more than others and it is important to locate the points of greatest vibration to correct or reinforce these parts. In sheet metal work for air conditioning, auto bodies, and so on, it is not only necessary to find out what bodies vibrate at different frequencies, but also where the nodes or centers of vibrations are. Other specific vibration problems will be listed later. We will now describe briefly the tools of vibration measurement.

As Aunt Maggie used to say in her homely way: "There are more ways to kill a cat than to choke him with butter." There are also more ways to measure vibration than the one described here. This method, however, is very simple compared to some others and is very well adapted

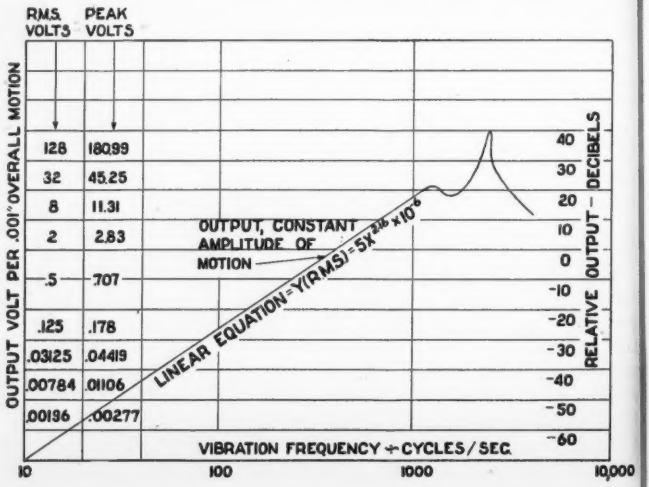


Fig. 4—Graph of Average Characteristics of a Vibration Pickup

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The instrument used in these studies is the Model No. 151 Neobeam Oscilloscope, illustrated in **Fig. 1.** Essentially the instrument consists of: (a) a specially constructed neon tube, the height of glow in which varies in direct proportion to the current passing through the tube; (b) rotating mirror for scanning these variations and thus observing the wave form; (c) a high gain amplifier for building up minute voltage impulses to sufficient strength to operate the neon oscilloscope tube; (d) an A. C. rectifier-type meter for measuring the amplifier output.

The exploring unit or "vibration pickup" is of the piezo electric crystal type. These are available in different types for special applications but we will confine ourselves to the inertia-operated type which is excellent for all around work. The vibration pick-up is illustrated in Fig. 2.

In this pickup a relatively large crystal is securely mounted within the aluminum housing of the pickup, but has no direct mechanical connection with the 8-in. duralumin test probe. When the hardened steel point of the probe is held against a vibrating surface, the entire pickup vibrates and the crystal vibrates and flexes of its own inertia. The bending of the crystal generates a voltage whose frequency and wave form are exactly the same as the frequency and wave form of the mechanical motion. This voltage in most cases is quite low and is fed into the input of the amplifier to the oscilloscope, **the input dial of which is calibrated against peak voltage.** In order to extend the input range, a rotary four-point switch selects approximate ranges and a calibration curve for each selection covers intermediate valves.

The output of the vibration pickup is also calibrated, in terms of frequency versus voltage at a constant amplitude of 0.001 in. The output voltage varies as the square of the frequency (twice the frequency, four times the voltage, triple the frequency, nine times the voltage, and so on), and directly as the amplitude. Thus, at 400 cycles and 0.001 in. overall motion the output is 2.83 peak volts. Since the output is proportional to the amplitude, at 0.0005 in. motion we would have an output of 1.41 volts.

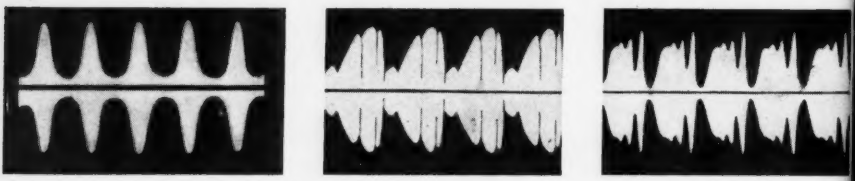

Fig. 5—Reproduction of Wave Forms of Vibrations as They Appear on the Oscilloscope Screen.

We can now outline the procedure of vibration measurement. After connecting the pickup to the input to the oscilloscope and turning on the switch which operates both the amplifier and scanning sweep, we see the wave form of the vibration appear in the oscilloscope as the pickup is applied to the vibrating surface. The screen of the oscilloscope is graduated in ¼-in. spaces and after determining the distance between cycle peaks in inches, the frequency of vibrations is calculated by the formula $\frac{R\,P\,M}{2\,L}$; R P M being the

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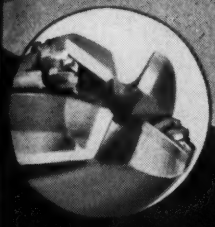

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speed of scanning as shown on the "sweep" dial and "1" the distance between cycle peaks in inches. In practice, the "sweep" is usually turned to the point where the cycle peaks are ½ in. apart and frequency is then read direct on the dial.

With the frequency known, we can now determine amplitude. As mentioned before, the input of the oscilloscope is calibrated against peak volts. This is the dial reading of the control knob (sensitivity) and is plotted against the voltage at which a constant output of 0.75 volts is realized from the amplifier of the oscilloscope. For a practical test, we apply our pickup against the frame of a motor. We turn the sensitivity (input) dial until the output meter reads 0.75 and reads 55 in the second position, which corresponds to a voltage of 0.2 on the second calibration curve. We find the frequency to average about 150 cycles. Interpolating on the pickup-output curve we find 150 cycles at .001 in. motion creates 0.275 peak volts. Our amplitude is, therefore, $\frac{0.200}{0.275} = 0.73$ thousandths or 0.00073 in. motion. That, by the wa is a smooth running motor.

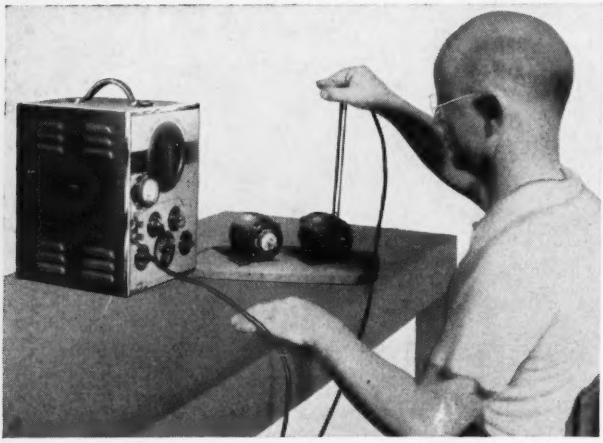

Fig. 6—Testing Two Electric Motors for Vibration

Vibration Tests

While on the subject of motors w will test two 1800 r.p.m 1/50 h.p. 6 cycle induction-type motors loaned t us by the courtesy of the Bodi Electric Company for the purposes this test and indicated as motors and B. In motor A, shown at the le in Fig. 6, the rot is dynamically ba anced; the other, is a motor rejecte as being out of ba ance. Both moto were placed on rubber pad to insu late them from benc vibrations and als to allow them to v brate with unlim ited freedom.

The balance motor, A, had no de tectable vibration a the fundamental fr quency produced b the rotor, namel about 30 cycles. Tw other frequencies, however, were note one at 120 cycles which we attribute to the stresses excited by the field coil and the other at 960 cycles. The 12 cycle vibrations, measured at the bas (maximum point), had an amplitud of 0.002 in. The 960-cycle vibratio measured as nearly as possible to th neutral axis with respect to the 12 cycle frequency, was determined a 0.00004 in. This is a very smooth ru ning motor and would be practicall inaudible in a quiet room.

The unbalanced motor had a ver distinct period at about 30 cycles, th amplitude of which averaged 0.006 i The amount of movement is sufficie to cause an appreciable hum since th entire motor is moving at this fr

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quency. Curiously, the 120 and 960-cycle vibrations measured practically the same as in the balanced motor—0.002 and 0.00006 in. respectively, at the point of maximum vibration. The tests seem to indicate that the 30-cycle disturbances are mechanical, while the 120 and 960-cycle vibrations are magnetic in origin.

Ball Bearing Tests

Another very practical vibration test is the production testing of ball bearings. In this test we will compare a precision bearing made by the Norma Hoffmann Bearing Corporation against a similar size unground bearing of the "cheap" variety. The bearings were mounted on the shaft of the balanced Bodine motor discussed above. Very little of the frame vibration was transmitted to the shaft and the motor shaft was therefore considered as having as smooth-running qualities as any test shaft that could conveniently be devised.

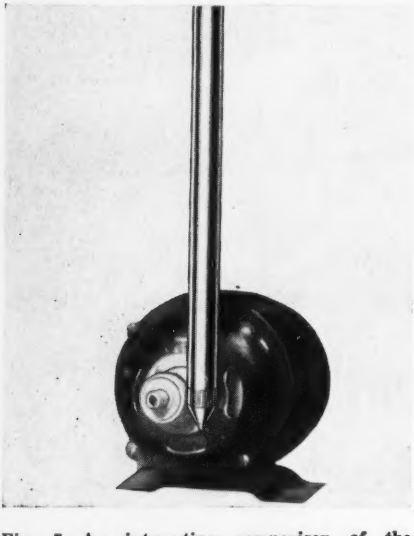

Fig. 7—An interesting comparison of the "running qualities" of ball bearings can be obtained by holding the knurled end of the pickup against the outer race of the bearing, at right angles to the diameter.

With the pickup prod held against the outer race of the unground ball bearing and parallel with its diameter, a great number of irregular frequencies were observed, the average of which was about 1600 cycles. The amplitude at this frequency is approximately 0.0001 in. No amplitude of vibration could be read on the precision bearing, due to the fact that the vibration of the test shaft was greater.

An interesting comparison of the "drag" or running smoothness of the bearings was obtained by holding the knurled end of the pickup against the outer race at **right angles** to the diameter as shown in Fig. 7. The shaft vibrations are in this way avoided. On the basis of this comparison, the vibration amplitude observed on the unground bearing was 0.000045 in. Readings on the precision bearing disclosed about the same frequencies of vibration (1600 to 1700) but the amplitude equivalent was only 0.0000037 in. The value of precision bearings in noise reduction is very apparent.

We will now consider a very important subject in the study of noise reduction-gear trains, although too much must not be expected from this brief survey. We will make no attempt to discuss the relationship of the factors involved in cutting gears to vibration and noise reduction. We will, however, discuss the differences caused by different materials used in gears. Undoubtedly a good deal of sales resistance, in the sale of bakelite gears, for instance, is due to the lack of comparative data on noise reduction between bakelite and metal gears. We will attempt to show what a valuable sales feature such data can be. We will also attempt to show the differences in noise volume between metal gears, such as steel and bronze for example.

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were made was a ½ h.p. 1725 r.p.m. motor with a 9 to 1 ratio reduction (See Fig. 8). In order to make the test as severe as possible from the vibration standpoint, the entire unit was floated on rubber pads. So that the tests could be made on the gear trains under load, and also under the same loads on each test, an ammeter was placed in the feed line to the motor and the brake load in the motor increased to the same current consumption on all tests. Tests were made using steel, bronze and composition transmission gears respectively.

Fig. 8—Testing Metal and Composition Gears for Vibration and Noise Volume.

The same condition was observed in these tests as in the motor balancing tests described above; i.e., several frequencies of vibration were present. These frequencies can be classified as follows: (1) a low frequency of about 30 cycles caused by the rotation of the rotor; (2) a 120-cycle component caused by the stress of the magnetic field; (3) relatively high frequencies caused by interaction of gear teeth.

The amplitude of the 30-cycle frequency was quite low, and being also a very low frequency in the scale of audible sounds, could be considered negligible from a noise standpoint. The 120-cycle component measured 0.0039 in. in overall amplitude at the point of greatest vibration which, in this machine, was at the base. In normal practice, the base would be securely fastened, whereas in this test it was floating. A point of interest that should be brought out here is that it is very seldom that a machine vibrates in its entirety, especially at frequencies above about 30 cycles. The machine vibration is usually in sections with nodes or "dead spots" in between. Thus, in this unit, while the vibration is relatively high on the base, there is a point on the top of the unit, directly above the gear case, where the 120-cycle frequency can hardly be detected. The vibration set up by the gears themselves is more complex.

Steel Gears

The basic frequency set up by the steel gears was determined at 620 and remained fairly constant. A secondary or high pitched vibration of very irregular frequency averaging about 1500 was also observed. In order to pick off the gear vibration more directly, the vibration pickup was applied to the center of the drive shaft, as shown in Fig. 8, as well as to the outside of the gear case. The amplitude of the 620 cycle vibration measured 0.00009 in. at the shaft and 0.000053 in. on the frame. The 1500 cycle frequency was too irregular to permit measurements.

Bronze Gears

Readings on the bronze gears indicated the same basic frequency of vi-

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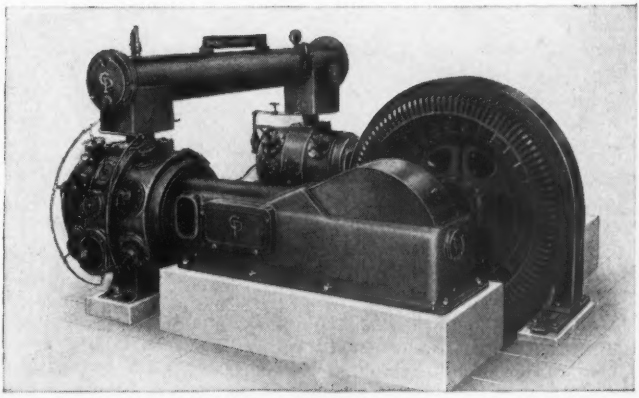

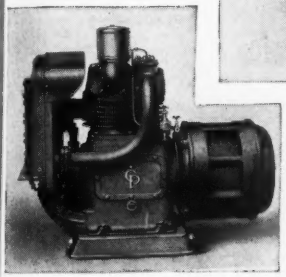

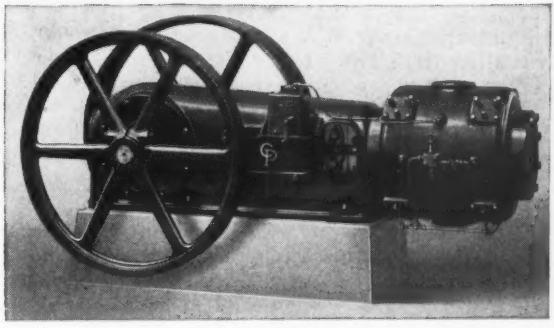

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bration as the steel gears but with a much lower intensity secondary vibration. The secondary vibration in this case averaged about the same frequency—1500. The amplitude of the 620-cycle frequency as read on the shaft end was 0.00008 in. and on the gear case, 0.000048 in. The tests seem to favor the bronze over the steel gears only slightly from a noise standpoint.

Bakelite Composition

The composition gears exhibited distinctly different characteristics in comparison to the steel and bronze gears. The basic frequency appeared to be about half of that of the steel or bronze gears, or 310 cycles with a second harmonic of 620 cycles apparently of about 25 per cent of the strength of the fundamental. Since these values of vibration are both low in frequency they seem much quieter than the high-pitched vibrations of the metallic gears. The amplitudes of vibration were also much lower than with metal gears, measuring 0.00028 in. for the 310-frequency and 0.000049 in. for the 620-frequency on the shaft end. On the gear case these amplitudes became 0.00019 in. and 0.000034 in. respectively.

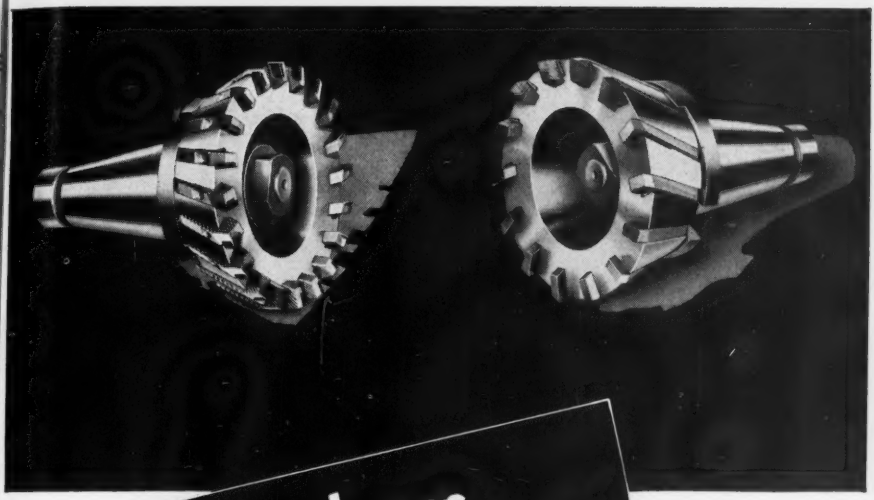
The values of amplitude given above are arrived at as follows: Two frequencies were observed, 310 and 620 cycles respectively, the latter being a 25 per cent second harmonic of the fundamental. Since the output voltage of the piezo electric pickup is squared with respect to frequency, the output at 620 cycles is four times the output at 310 cycles. It follows that if the voltage output at each frequency were equal, the 620 component would be one-fourth of the fundamental. It happened that this came near being the case in this instance.

In summarizing the data given above, it should be remembered that the noise producing effectiveness of a vibrating surface varies as the law o squares mentioned above. It take four times as much energy to vibrat a body 0.001 in. at 620 cycles as it does at 310 cycles. The energy o the noise created is increased in th same proportion. Putting it anothe way, the vibration amplitude at 62 cycles could be 0.001 in. and th amplitude at 310 cycles could be .00 in. and the sounds produced woul have about the same energy.

It is this principle that to a larg degree makes the steel and bronz gears seem so much noisier than thos made of bakelite. The high frequencies generated, while of small amplitude, have a high energy-value an are carried above other sounds. In addition, the feature of irregularity contributes to their noisiness. Sounds of constant frequency and frequencies that bear simple numerical ratios to one another sound pleasant to the ear. In addition, the high frequencies produced by the steel and bronze gears happen to be in the range of the most acute physiological perception. From the standpoint of noise reduction, the composition gears lead by a wide margin.

The Study of Noises

For the benefit of those not familiar with the study of noises we might explain that sounds are now almost universally measured in terms of decibels. This is essentially a logarithmic sound-energy scale approximating closely the response characteristics of the ear. It is because of these characteristics that the ear is able to hear the rustle of a leaf and still not be injured by sounds of thunder having 100 billion times as much sound energy. Zero decibel reference level is 6 milliwatts of audio power. The purr of a cat is about 20 decibels, a quiet office 35 decibels, a police whistle 85 decibels, a roaring lion 90 decibels, and an airplane motor 110 decibels. A good deal of research has been de-



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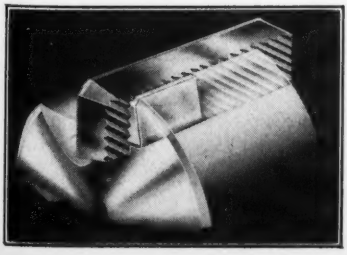

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voted to determining the relationship of noise to human efficiency during the last few years. A brief bibliography on this subject and on noise and vibration in general is given below.

In reviewing these works, several points seem evident. (1) The effect of noise on metal or physical efficiency varies greatly from one individual to another. (2) Noise always lowers efficiency (up to 10 per cent in some cases) and never improves it outside of exceptional cases. (3) Soft music is generally conceded to improve efficiency anywhere up to 10 per cent. Many firms play music from records through amplifiers during 15 minute recess periods during morning and afternoon. In Europe and Great Britain several large companies are playing music continuously during working hours. (4) That noises below 60 decibels do not appreciably affect efficiency.

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Physical Review:
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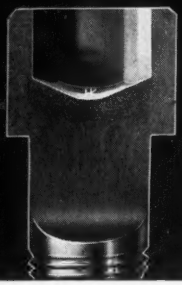

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Some Remarks About the Rolling of Metal

By A. L. De Leeuw
Consulting Engineer

THERE seems to be considerable difference of opinion as to what happens when metal is reduced in thickness by rolling. The probable reason for this difference is that there is not just one thing happening, but a continuously changing set of things. Considerable research might be undertaken, and, possibly, is being undertaken about this subject with promise of important results. However, there are certain facts that should be recognized without the need for experimentation. They are the logical results of the laws of mechanics and should be the starting points for whatever research might be undertaken.

It is commonly accepted by those engaged in the rolling of metal that a certain amount of pressure is required for that work. The idea is that the metal must be gripped between the rolls with a pressure of which the amount varies with the nature of the metal, its width, and the amount of the desired reduction. It is true that there is such pressure, but it is the result and not the cause of the action of the rolls. In other words, it is not necessary to make provision for the furnishing of a certain amount of pressure in order to start rolling; to the contrary, pressure is a disagreeable, though unavoidable, by-product of the action of the rolls upon the metal. That this is so is readily seen when one considers what happens when a strip of metal is introduced into the rolls.

Let us assume that a coil of strip-steel has been run through the rolls. The pressure gage has indicated that there was a pressure of, let us say, 100,000 lbs. The coil has been run off and a new coil is to be started. Of course there is now no pressure. In order to start, the operator pushes the end of the strip between the rolls, and the slight pressure the man can exert is sufficient to start the operation. However, as soon as the metal is between the rolls, the gage shows that pressure of 100,000 lbs. has again developed. If the rolling were done at an extremely slow rate, one would see the hand of the dial gage move as it gradually creeps up to the 100,000-pound graduation. This shows that the pressure was developed by the rolling; in other words, that pressure is an effect and not a cause.

What happened when the new coil was introduced was this: the slight pressure of the stock against the rolls caused friction between the moving rolls and the stationary steel strip. If the initial pressure—horizontal pressure—was sufficient, the friction was enough to keep the rolls from sliding over the stock and the stock was taken along. The stock was being **pulled** forward and became wedge-shaped, and this wedge, in its forward movement, forced the rolls apart, or, rather, tended to force

them apart.

The work done by the rolls is twofold. Some of it is used for the reduction of the metal, which necessitates the rearrangement of the molecules and creates heat as a by-product. Another portion of the work done is used to slide the rolls over the stock; in other words, to overcome friction. That there must be such sliding is evident when it is considered that the same amount of metal flows out of the rolls as comes in, and as the outgoing metal is of less thickness than the incoming material, its speed must be greater. As the rolls cannot run at the higher and lower speed simultaneously, and as this sliding takes place under pressure, work is done to overcome the resulting friction. The total amount of work required for a given reduction, as well as the proportion of its two component parts, depends on the arrangement of the machine.

The effect of the size of the rolls shall first be discussed. It is well known that better results are obtained and that less power is required with small than with large rolls. Modern mills are built with the smallest practicable rolls. However, there seems to be a misunderstanding in many minds as to why this should be so.

As an example, it will be assumed that 0.080 in. stock is to be reduced to a thickness of 0.060 in. If this is done by 20-in. rolls, then the length of the arc of contact between stock and rolls is 0.447 in, and if it is done by 3-in. rolls, this length is 0.173 in. The ratio between the two amounts is more than two and a half. It is thought that this lesser area causes the pressure to be less, and although this is true to a small extent, this lesser pressure is not the main reason for the reduction in the amount of power required.

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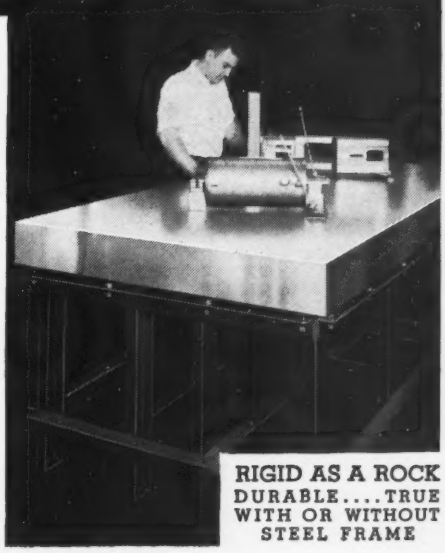

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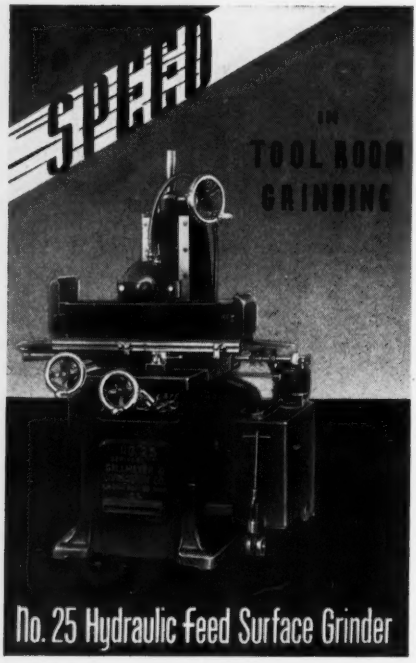

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The most important reason is that each element of the rolls must slide over the entire arc of contact. If the pressures are the same, then the amount of work done to overcome this sliding friction is more than two and a half times as great for the 20-in. as for the 3-in. rolls. In addition, the pressure is less with the smaller rolls, as was mentioned above, but the difference is not great, as will be seen later.

The statement that the rolls push a wedge of metal between them is true if one forgets that the shape of the piece of metal in contact with the rolls is not of even slope. The top and bottom surfaces are not plane surfaces but part of cylinders. There is a changing of slope from the entering to the leaving side. The angle of the slope is greatest at the point where the stock enters and, therefore, at that point the vertical effect of the wedge is a minimum. A simple calculation would show what the average must be. The entering angle is smaller the greater the diameter of the rolls, and, consequently, the average active angle also varies the same way. As the vertical pressure produced by the wedge is greater the smaller the angle, it follows that heavier pressures must be developed by the larger rolls.

The average angle of the wedge depends not only on the size of the rolls. It increases with increased thickness of the stock and with the amount of reduction. The average angle is larger when stock of 0.080 in. is reduced to 0.070 in. than when stock of 0.040 in. is reduced to 0.030 in. This explains why a disproportionate amount of power is required to reduce thin stock a small amount.

The relation between entering and leaving speeds of the stock is not quite so simple as it may look at first glance. To illustrate what really happens, the following example

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is taken. The entering stock has a thickness of 0.080 in. and is to be reduced to a thickness of 0.060 in. The surface speed of the rolls is 400 ft. per min. The question is—what is the entering speed? It would seem that this must be 300 ft. per min. in order that the same amount of metal shall enter as goes out of the rolls. A more careful look convinces

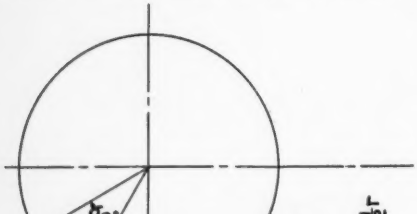

Diagram illustrating relation of pressure to rolling of metal

one that this cannot be the case.

The distance between the rolls must be somewhat more than the thickness of the outflowing metal. The amount is very small, but the fact is important. To assume that the distance is exactly equal to the thickness of the outflowing metal leads to a reductio ad absurdam. The metal would still be under pressure at the point where it leaves the rolls; that is, where it crosses the plane through the centerlines of the rolls, and if there is pressure at this point, then there must be a wedging action. This means that there is still some reducing action going on at the point where the stock leaves the rolls. The thickness of the stock would be somewhat less than the distance between the rolls, and this conclusion is reached by assuming that the thickness is equal to the distance between the rolls.

The last point where any reduction takes place must be a little distance back of the plane going through the axes of the rolls. This leads to the following possibilities:

If the entering speed is 300 ft. per min., the thickness 0.080 in. and the rolls are 0.060 in. apart and have a surface speed of 400 ft. per min., then the material issues from the rolls at more than 400 ft. per min., and the thickness is less than 0.060 in.

If the data of the previous paragraph are taken, but if it is assumed that the material flows out at a speed of 400 ft. per min., then the rolls must be a little more than 0.060 in. apart and must have a speed of somewhat less than 400 ft. per minute.

So far, consideration has been given to two elements of the amount of power required for the reduction of metal, namely, work required for the

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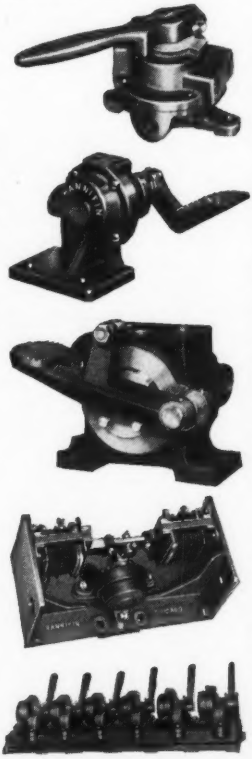

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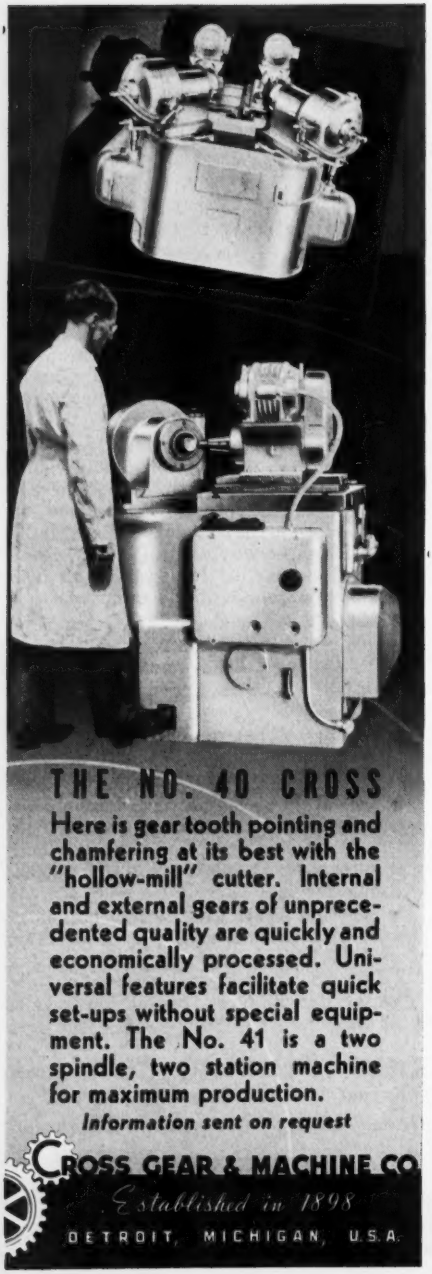
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rearrangement of the molecules, and that required to overcome friction between rolls and stock. There is also a third element. This is the work required for compressing the stock while it is being rolled. This also is work done for the rearrangement of the molecules, but this new arrangement is temporary and serves no useful purpose. This element is waste so far as the final result is concerned. The accompanying diagram represents an imaginary condition of rolling metal, a condition such as one would never meet in practice, but well adapted to show with simple computations that there must be such compression. The amounts would be smaller in practice, but the principle would be the same.

The roll turns with a speed **s**. The stock strikes the roll at a point 30 degrees below the center. The thickness of this stock above the bottom of the roll is **t**, which, in this case, is equal to ½ **r**, if **r** is to be the radius of the roll. For a first consideration of what must happen, it will be assumed that there can be no slip between stock and roll; a condition that would exist if the roll were armed with sharp teeth. The roll has the tendency to draw the stock in at a speed of ½ **s**. The amount that would be drawn in, if it could be drawn in at all, would be **tw** x ½**s**, **w** being the width of the material. As **t** equals ½ **s**, the amount can be written as ¼ **wrs**.

At the point **Q**, where the radius makes an angle of 30 degrees with the vertical, the thickness of the stock above the bottom of the roll is 0.134 **r** and the speed with which the roll tends to draw in the stock is 0.866 **s**, so that there is a tendency to draw in an amount of stock equal to 0.866x0.134 **wrs**. This is less than what was to be drawn in at point **P** so that the material between the points **P** and **Q** must have been compressed.

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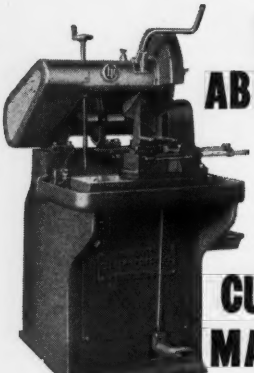

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The actual condition is different only to the extent that the roll is not armed with sharp teeth, but the tendency to compress the metal is there just the same. There is friction instead of the sharp teeth, and in actual practice it would not be possible to present metal to the roll in the manner indicated in the diagram. The angles would be much smaller. However, though the amounts would be different, the general nature of the result would be the same as in the illustration. The tendency to compress downward becomes a compressive stress forward and backward.

Various systems are in use for the rolling of metal. The means used are power driven rolls, forward tension and back tension. The latter element is, of course, never used alone. Power driven rolls alone are used, and were, not so long ago, the only known arrangement of rolling mills. In modern mills power driven rolls are sometimes combined with forward tension, sometimes with back tension, and sometimes with both. Forward tension alone is used—the rolls being of the nature of idlers—and it may be combined with back tension.

Forward tension may be used for different purposes. There may be just enough tension to cause the stock to reel up smoothly, or there may be enough to remove the wrinkles in the rolled stock, or there may be still more, so that it plays an important rôle in the process of reduction. Finally, it may be the only means to reduce the thickness of the metal. Even the smallest amount of forward tension used has some effect on the rolling, but this effect is often too small to be of practical importance.

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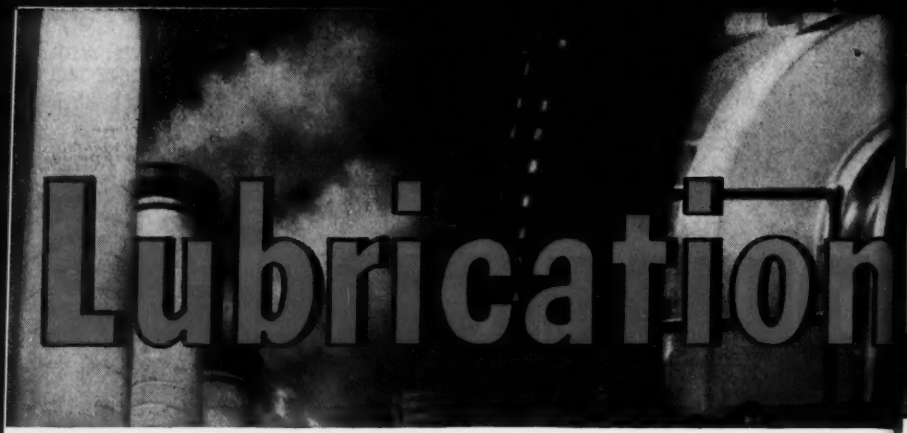

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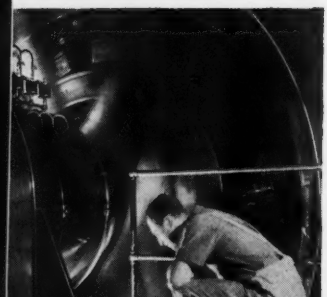

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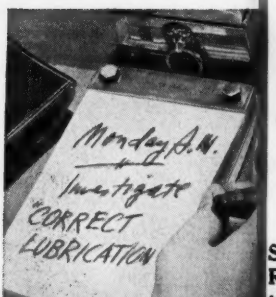

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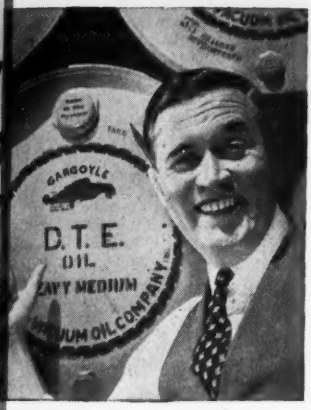

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being larger at one end than at the other, the stock will be thinner at one edge than at the other. The strip is longer at the thin than at the thick part, and wrinkling results. If the difference is great, the result may be that the stock, as it comes from the rolls, will have a tendency to curve sidewise.

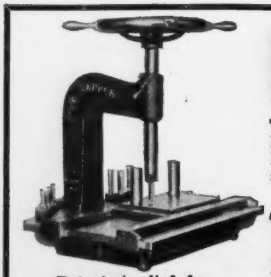
Another cause of wrinkling may be that the contour of the rolls is not correct. If the rolls are thicker in the center than at the ends, the metal will be rolled thinner — and, therefore, longer — in the center of its width than at the edges, and the metal bulges in the center. If, on the contrary, the diameter of the rolls is greater at the ends than at the center, the edges will be thinner and longer and wrinkles will be formed at one or both edges.

Though it is possible to avoid both the aforementioned causes of wrinkling by careful workmanship and accurate setting of the machine, there is still another cause that cannot be so easily eliminated. This is the unequal heating of the rolls. Heat is developed by the action of rolling. It is developed in the rolls as well as in the stock, though to a less extent. Though the rolls are hardened, there is a small amount of compression and distortion of the metal under pressure, and the result of this is heat. Then there is the heat the roll receives from the heated stock.

Finally, there is the heat interchange between the rolls and their bearings. If the roll is hotter than the bearing, it will deliver heat to that bearing and the ends of the roll will be cooler than the center part, resulting in uneven expansion and a change of contour. If the roll is cooler than its bearings, it receives heat and the ends will be hotter than the center. In either case there will be an uneven heating of the roll, with the resultant change of contour. These effects are less noticeable with large rolls than with small ones, on account of their capacity to absorb a great deal of heat with a moderate rise in temperature.

In the case of small rolls, there is still another cause of distortion, namely, the bending of the rolls. As, in practice, small rolls are never used except when they are backed by large ones, there is no appreciable bending in a vertical plane. However, there may be appreciable bending in the horizontal plane. Fortunately the amount of such horizontal bending must be considerable before it has any effect worth mentioning on the distance between the rolls.

As an example, it will be assumed that the rolls are 3 in. in diameter and that they are backed up by rolls with a diameter of 24 in., and further that the horizontal force acting on the rolls is sufficient to deflect them 0.003 in. in the center. Under these conditions the vertical deflection will be three eight-millionths of an inch,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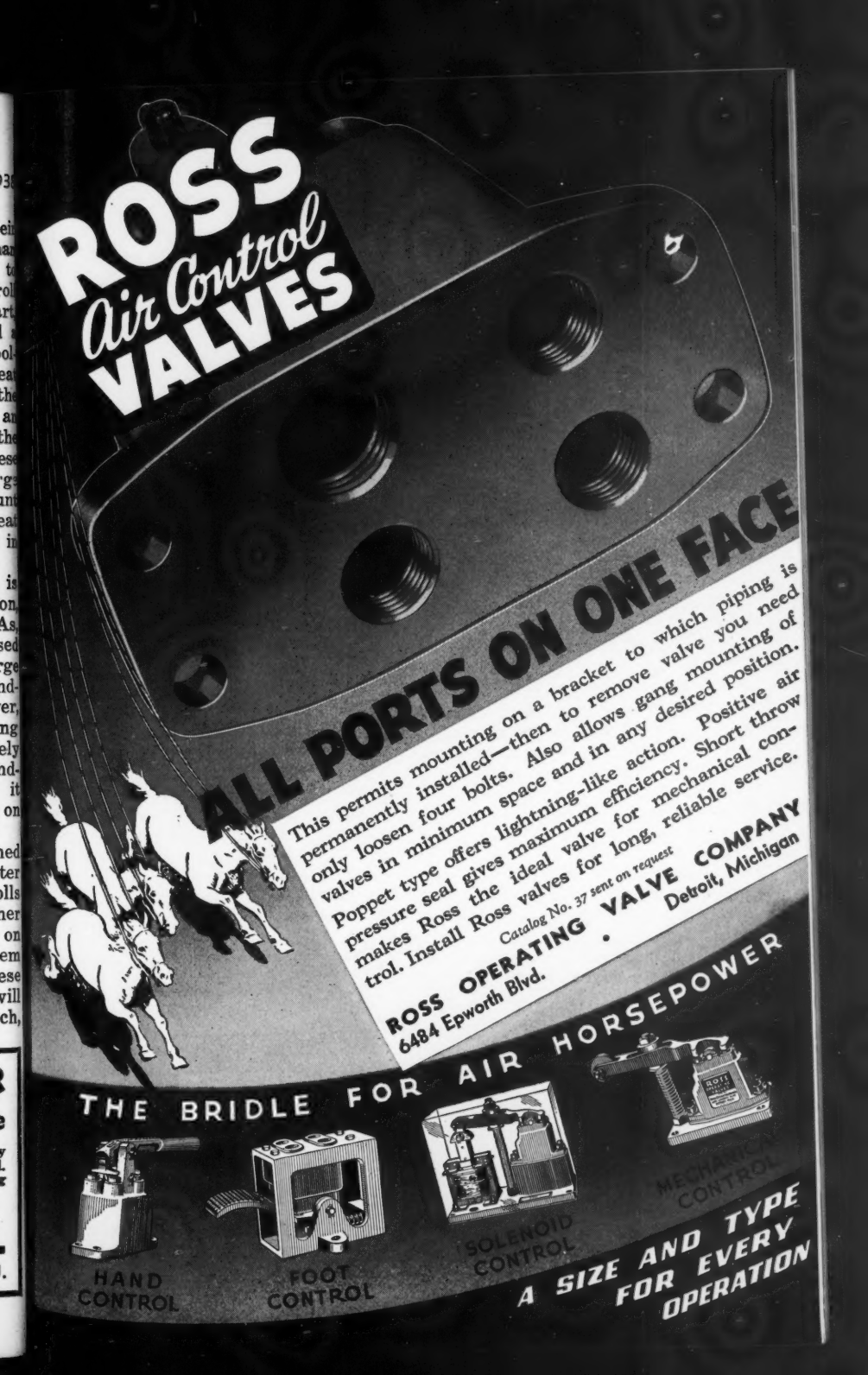

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and the stock will be double that amount thicker in the center than at the edges. Such an amount is so much smaller than other unavoidable faults, that it may well be disregarded.

When the forward tension is the only means used for the reduction of the material, the rolls must be again somewhat farther apart than the desired thickness of the rolled stock. If they were not, then there would be a further reduction after the stock has left the rolls, for the amount of tension must be greater than the tensional elastic limit of the material. The last point of contact between stock and rolls must be somewhere back of the plane going through the axes. The condition of the stock after leaving the rolls resembles the condition of a stream of liquid after it leaves the opening from which it issued.

As some of the reduction takes place outside of the rolls, it follows that the arc of contact is less than when the reduction is accomplished by power-driven rolls. This results in a further reduction of power required. The speed of the rolls is again less than that of the unfinished material.

It seems that the effect of lubrication is somewhat in doubt. There are cases when lubrication appears to have a beneficial effect, and other cases when it is not possible to say that lubrication had any effect at all. There is evidence that the use of some heavy lubricant does reduce the power requirements, but heavy lubricant cannot always be used. The question naturally arises as to how it would be possible for the lubricant to get between roll and stock, considering that the pressure is many times greater than what one meets in bearings.

However, it is possible to visualize the entrance of a lubricant when back tension is used, for then there will be some opening between the roll and stock at the point of entrance. Even so, only heavy lubricants will remain on the stock when under pressure. That they can do so is due to the fact that lubricating oil takes on all the attributes of a solid material when it is under heavy pressure.

At the point where the entering material meets the roll, the pressure is not very high and a certain amount of oil can enter. Shortly after, the pressure is so much greater that the oil is solidified. It then adheres to the metal through absorption; in other words, it is welded to the material to be rolled. There is some evidence that this is actually the case, for the finished material still retains some of the lubricant which is so strongly attached to the metal that it is almost impossible to remove it.

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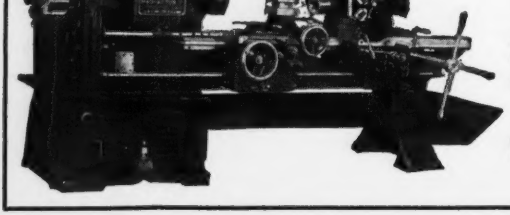

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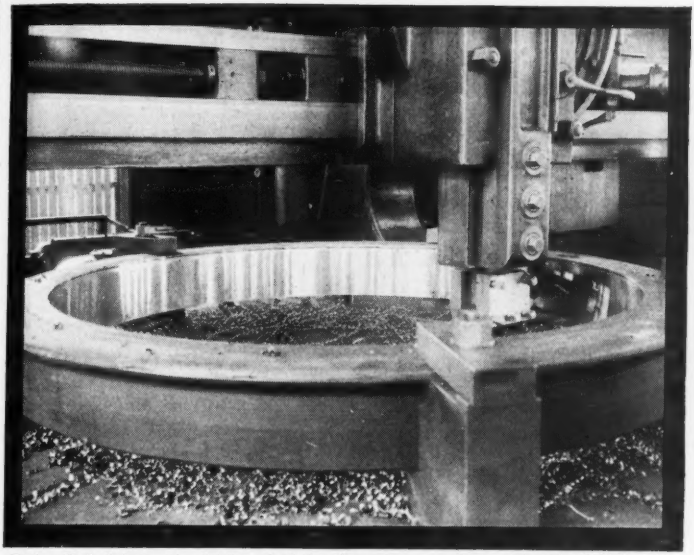

Boring 50 inch locomotive driving wheel tire. Operations: rough cut with style 12 V-R tool, finish cut and cut retaining ring grooves with style 16 V-R tool. The unretouched photograph clearly shows the mirror like finish produced. Comparative results with H.S.S., and with V-R tools:

Tool Material	ROUGHING CUT				FINISHING CUT				Cutting Time per tire complete
	Feed	Depth	Speed	Tires per grind	Feed	Depth	Speed	Tires per grind	
Vascoloy-Ramet	1/16"	1/16" to 1/4"	190 SFM	7	1/16"	1/16"	320 SFM	15	27 Min.
High Speed Steel	3/32"	1/16" to 1/4"	60 SFM	3	1/16"	1/16"	66 SFM	1	47 Min.

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The speed of roughing cuts was increased from 60 to 190, and finishing cuts from 66 to 320 S.F.M., when V-R tools replaced high speed steel.

Because of the high speeds possible with V-R, the primary purpose of the tests—a smooth, mirror finish—was accomplished. And, in addition, tire production and the number of tires bored per tool grind, have been materially increased, as shown in the comparative table above.

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Economical Lamination Punchings with High Speed Roller Fed Commercial Dieing Machines

By C. L. Szalanczy,
Tools and Equipment Dept. Westinghouse Electric & Manufacturing Co.

IMPROVEMENTS both in stamping machines and in manufacturing methods are developed almost continuously. At present, many progressive manufacturers are renewing old, worn-out equipment for which parts orders will be placed that must be filled in the shortest time possible. The reason for this is either to meet competition or to satisfy the time demands of the customer. Industry must keep abreast of the times and constantly improve its products while, at the same time, speeding up production methods. Furthermore, raw material waste must be reduced.

In the metal stamping plant one of the most successful ways to increase production is by installing and using commercial dieing machines wherever possible and thus doing away with the old, slow method of hand feeding. It is now becoming more and more common to see a battery of these dieing machines in up to date stamping plants. They are doing not only the simple piercing and blanking, but are actually performing six or seven operations. The range of such a tool may include difficult bending and forming, thus completing the piece of work or blank with the one tool instead of the several dies and their presses that were required when operating and producing by the older method.

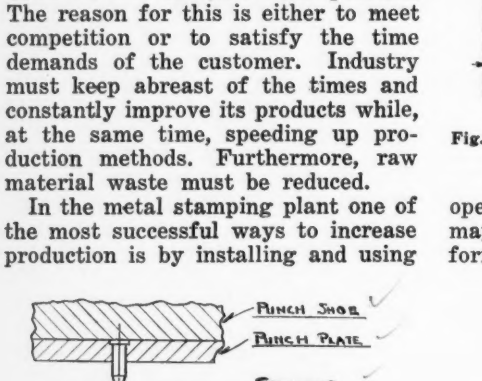

Fig. 1—Drawing illustrating condition developed when the blank material does not advance to the correct stamping position.

In the modern dieing machine, as the blanks are made at each stroke of the press the machine automatically advances the raw material to approximately the correct distance between each of the successful operating positions. The slight inaccuracy that may occur in the forward movement of the blank strip or sheet is usually corrected with the aid of pilots that enter the openings in the blank material. These openings may be holes or any cut-out part of the

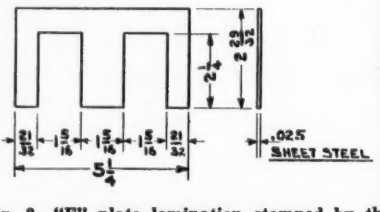

Fig. 2—"E" plate lamination stamped by the progressive die illustrated in Fig. 3.

blank that has been removed in a previous operation. The pilots also help to reduce the material waste by eliminating miscuts. This feature is a great help towards keeping the die in good operating condition.

When pilots were not provided in the die, the strip material frequently failed to feed up to its correct position for the next cutting operation. Then, in case a frail punch came down and hit only on a portion of the blank material, the punch either broke or bent, often fracturing the die. Both punch and die either had to be repaired or renewed. See Fig. 1. The small saving made by leaving out a pilot is quite frequently offset by the ensuing repair bill. It is thus best and also less costly to provide the necessary pilots.

Scrap or waste is considered in the punch shop as that part of the raw material in the sheet, strip or reel form that is not used in the production of the finished blank. Any saving of this material during the process of fabrication is in line with the extensive movement of reducing the cost of the punched parts. Of course there will always be some scrap. It can not be entirely eliminated, but by careful planning of the arrangement of the blanks when the tool is being designed, waste can be held to the minimum.

The tools used in the roller-fed dieing machine are of the progressive type. Due to the construction of the machine, with its four large guiding posts that insure perfect alignment at all times, the press may be run at a high rate of speed. This means that the tool used in such a press will require less attention and will usually require fewer grindings, which naturally means a longer die life at a lower cost of upkeep.

Figure 2 illustrates a typical "E" plate lamination punching made of 0.025-in. thick sheet used in the fabrication of electrical transformers. In Fig. 3 is shown a specially-built progressive die that produces two of these "E" plate punchings at each stroke of the press after the second cut. With the conservation of raw material in mind, the blank strip should be sheared slightly wider than the dimension of the two blanks when they are interlocked. The arrangement in Fig. 4 allows just sufficient material on each side for carrying the raw material through the feeding rolls.

Construction of the Progressive Die

Item 1, Fig. 3, is the die shoe, which is made of heavy stock hot rolled steel plate. It is finished smooth on both surfaces. The two clamping ledges on the sides are rough machined and the clearance holes through which the blanks drop are machined smooth so the blanks will not catch and start to pile up. Item 2 is the guide pin. There are

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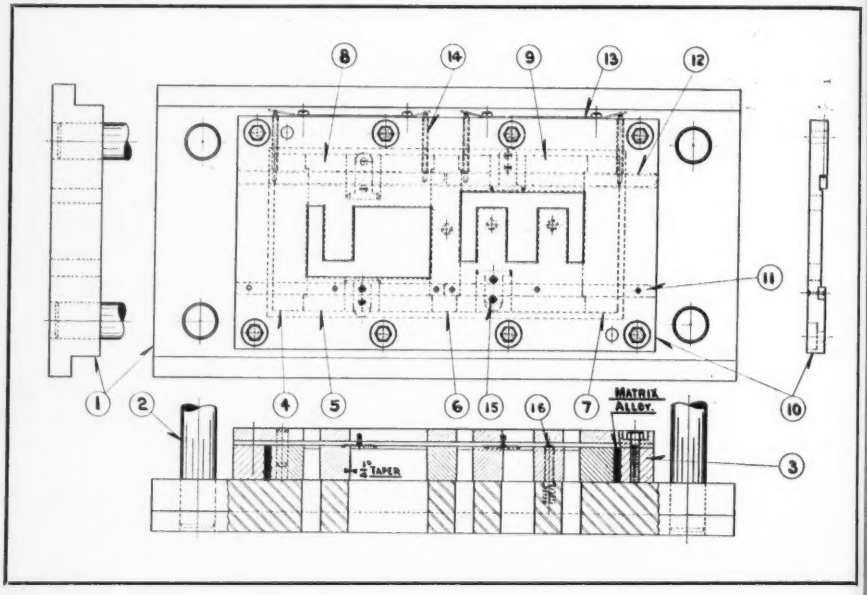

Fig. 3—Lower Half of Progressive Die

four of these employed. They are made of round stock hot rolled steel, finish machined and case hardened to resist wear.

Item 3 is the die piece holder plate, made of hot rolled steel of the same thickness as the die pieces. This plate is machined smooth on the top and bottom surfaces and the opening in the center is made a little larger than the combined dimensions of the die pieces. This opening may be machined out or burned out roughly. A number of anchorage holes should be chipped in along the sides for anchoring the matrix alloy that is used in place of a shrink plate for holding the die pieces. This plate is fastened to the bottom die shoe by means of hexagon head bolts and located by means of two hardened dowels. It is best to use hardened dowels to prevent shearing off in case of some sudden strain.

Items 4, 5, 6, 7, 8 and 9 are the sectional die pieces. Since practically all tool departments have their own established brands of tool steels, calculated to be best adapted for their purposes, all that needs to be said about the material for the die pieces is that they may be made from almost any of the well known tool steels. The die pieces are machined up to nearly correct sizes, drilled and tapped for bolts and dowels, and then hardened in an open fire to 85-90 scleroscope. They are then ground to the specified tool sketch sizes and assembled on the die shoe and anchored.

The stripper plate 10 is of hot rolled steel, finish machined on the top and bottom, and has a groove in the center through which the blank material passes. On the side facing the front, the groove is lined with two strips of tool steel which has been tempered to file hardness to resist wear. This is necessary since

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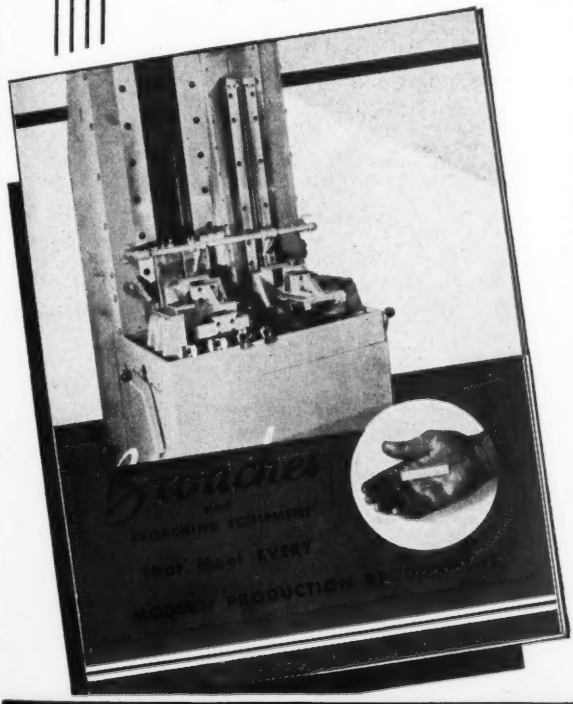

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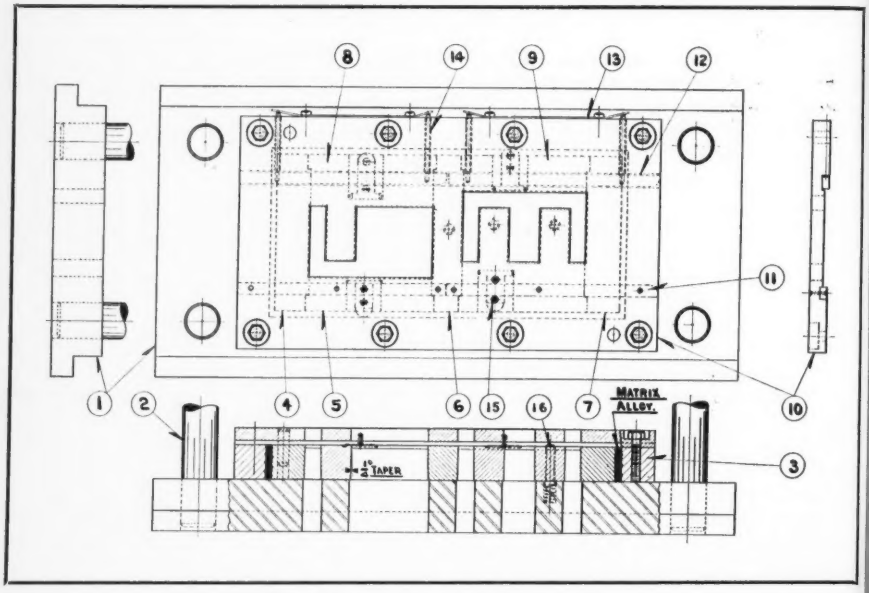

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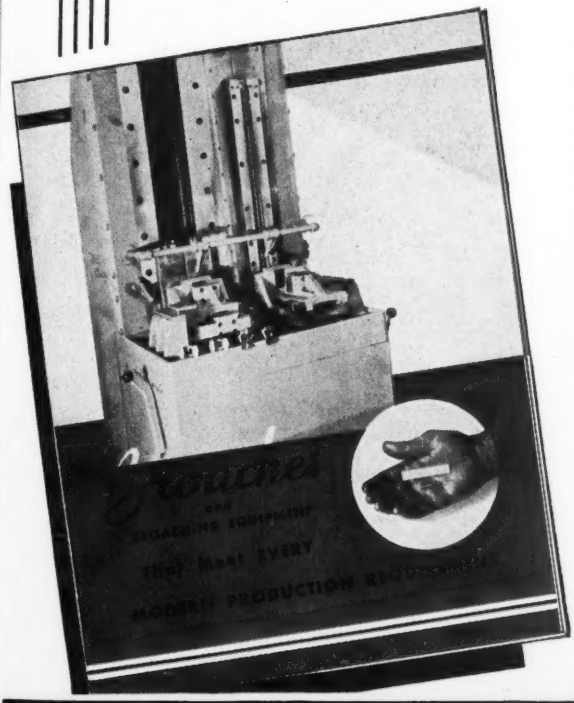

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the blank material is continually bearing against it. This liner strip is marked 11 in the third illustration. It is held in place with several countersunk headed rivets.

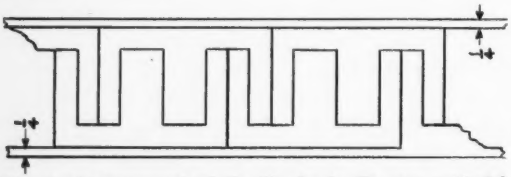

Fig. 4—Arrangement of the blanks in the raw material and the strips of scrap on the two sides that are necessary to pull the material through the die.

On the opposite side, items 12 are two stripper bars used for guiding and keeping the blank material up against the front liner 11. It may be noted that these bars have a clearance in the groove that allows 1/32 inch of movement on either side. Thus, even if the raw material is sheared slightly over or under size, the bars will adjust themselves and force the material toward the front bars. This is quite important since it serves to reduce the work of the pilot in bringing the blank material to the correct punching position.

Items 13 are the flat springs at the back that actuate the stripper bars by bearing against the stripper pins, indicated as items 14. These pins are press fitted into the bars so that they will not work out while in operation. The flat springs are fastened to the back of the stripper with two small fillister head screws. The stripper is located on the die where it is positioned with dowels and is fastened down with a number of bolts.

Items 15 are the lifters that aid the disappearing pins items 16 to lift the partially blanked material strip up high enough above the sliding surface on the die so it will not catch. Items 15 are of thin flat spring steel stock, cut out to suit the die condition and space. It is held up to the stripper with two small flat head screws. The lifters are slightly bent downward on the ends to facilitate the sliding of the material.

The disappearing pins are made of

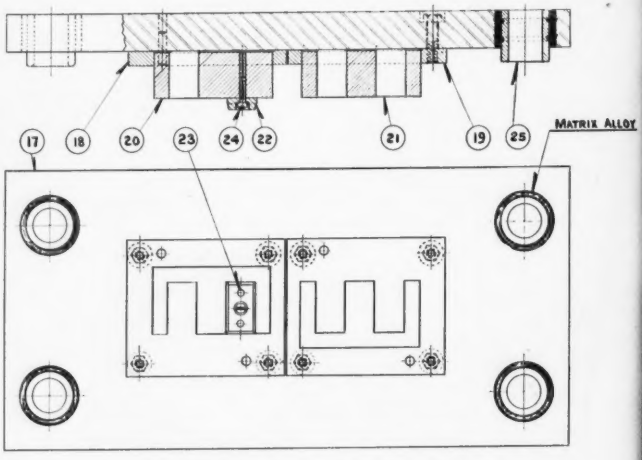

Fig. 5—Upper Part of Progressive Die

stub steel with a small shoulder on the lower end, the upper end being rounded off. They are case hardened and are actuated by a small compression spring that is set into the die shoe under each of the pins. Three of these pins have been found sufficient for the work in these dies.

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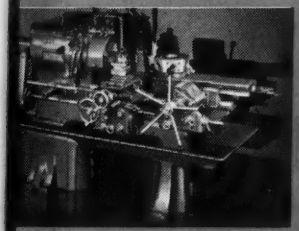

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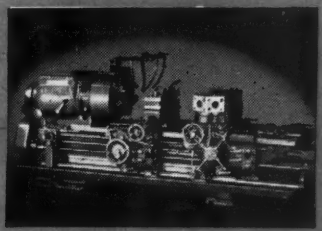

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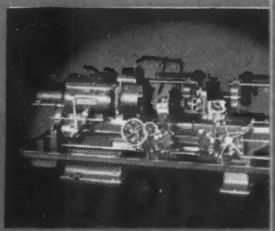

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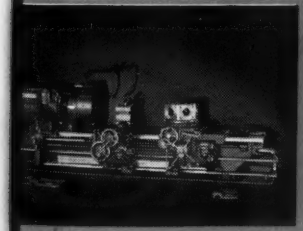
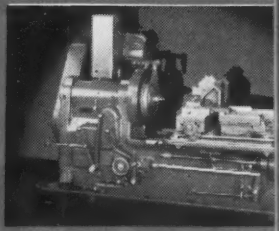


holt 4-L and 5-L Heavy-Duty Turret Lathes

★ (left)—*Gisholt Static and Dynamic Balancing Machines*; (right)—*Gisholt Tool Grinders*



★ *Gisholt Standard and Radial-type Simplimatic Lathes*

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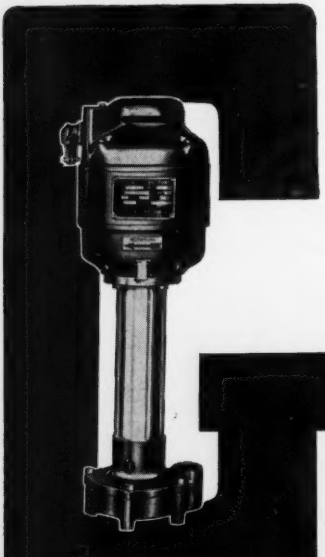
Both the die pieces and the stripper must be machined out over the area where the lifters are set. It might be mentioned also that all cutting edges of the die are straight for ⅛ of an inch only. From this dimension down to the bottom of the die a small taper suitable to the thickness of the punched material should be ground always towards the outside so as to allow the blanks to pass through. If this clearance taper were not provided, the blanks would stack in the die and it would actually require more pressure to push them out of the die than it took previously to stamp them out of the material.

Fig. 5 illustrates the upper part of the punch section. Item 17 in the punch shoe, which is made of hot rolled steel, finish machined on both the top and bottom. The punch holder plates 18 and 19 are of hot rolled steel, slab-ground on the upper and lower surfaces, and machined out to press fit size to suit the punches items 20 and 21.

These punches are made of tool steel, machined nearly to size and hardened to about 85-90 scleroscope in an open fire furnace. The upper ends of the punches are drawn back to about 35-40 scleroscope so that they can be peened over as shown in the illustration to form a shoulder. The shoulder will act as a cushion for the hard punch and thus stop it from sinking into the soft steel punch shoe, in addition to which it will prevent the punches from pulling out of the punch plate during the stripping.

In cases where heavy material is being stamped, it will be advantageous to further anchor the punches with several hex head bolts that fastens them directly to the punch shoe. The punches are ground all over to the specified tool drawing sizes and should have the necessary shearing



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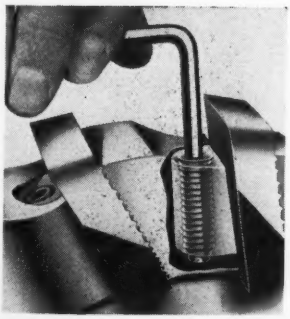
McCrosky JACK-LOCK Special Purpose Tools Cut Costs by Combining Cuts



JACK-LOCK Wedge
McCrosky's positive and compact JACK-LOCK Wedge can be locked or unlocked without hammering.

BORE four different diameters and face two shoulders in one operation—that is the job to which the above JACK-LOCK Tool was engineered. It cuts costs by saving time and insuring concentricity. Incorporated in it are three exclusive McCrosky features ● the positive JACK-LOCK Wedge ● TRU-GROUND Serrations ground from the solid after hardening ● Individual Adjusting Screw behind each blade. For your reference file send for Bulletin No. 15-F showing many examples of similar special JACK-LOCK Tools that cut costs.

McCrosky Tool Corporation, Meadville, Pa.

provided from the ends to the center to assist in cutting the blank material.

Item 22 is the pilot used for bringing the blank material into the correct stamping position. The pilot is made of tool steel, hardened and ground. At the base it takes the form of the punch and has a ⅛ in. high flat surface that slip fits into the opening in the material and about a ¾ in. lead that is tapered about

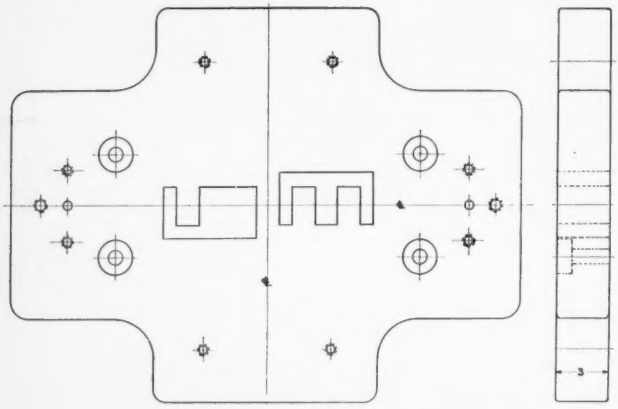


Fig. 6—Special Bolster Plate Used Under Die

15 degrees in towards the bottom to facilitate entering. The pilot is fastened to the punch with a fillister head screw item 24 and kept in position by the two dowels items 23.

The guide pin bushing item 25 is a stock part. Four bushings are used, located from the die and held in place with matrix alloy.

When building a die for use in a dieing machine, it is customary to make a special bolster plate for each die similar to that illustrated in Fig. 6. It is made of hot rolled steel plate, burned out to shape to clear the guide posts on the dieing machine. Generally no machining is required on these burned surfaces.

The bolster plate should be of sufficient thickness to support the center of the die so that no bending may occur when the stamping pressure is applied. The plate must be finish-machined on the top and bottom surfaces to assure level setting on the dieing machine and also for the die. The bolster contains all the necessary holes for attaching it to the stamping press in addition to the dowel and tapped holes for mounting the die. Clearance holes are planned and provided through the bolster plate to allow the blanks to pass through.

For better handling facilities and quicker packing of the finished blanks, a set of stackers or chutes are made of angle iron and are placed under the holes in the bolster plate. Then, as the blanks drop down on the stackers, they accumulate one against the other and keep moving toward the outide where the press operator can remove them from time to time and pack them into the shipping boxes provided for that purpose.

Zinc Alloy Die Castings. The new Jersey Zinc Company, 160 Front St., New York, N. Y., has announced the preparation of a series of booklets to illustrate the growth of the die casting industry in the various industrial fields. The first two books of the series—"Zinc Alloy Die Castings in Electrical Equipment" and "Zinc Alloy Die Castings in Business Machines"—are now ready for distribution. The many examples of complete assemblies of zinc alloy die castings shown in these booklets should be of interest to the man who is active in the development and fabrication of metal products, whether or not he is directly associated with the particular industries covered. Copies of the booklets free upon request.

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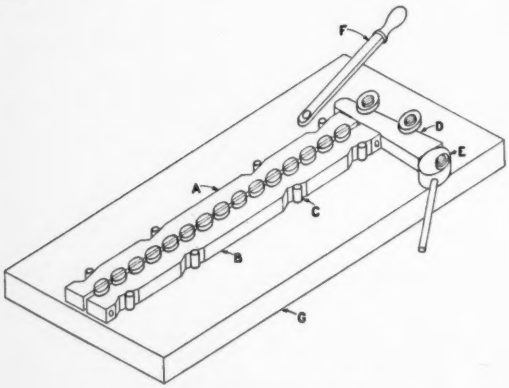
Quick-Action Screw Slotting Fixture

By Chas. H. Willey

IN the small job shop where, at intervals, the work includes machining parts and assembling units for machines, it occasionally becomes necessary to make up small lots of special screws. When the screw-heads are to be slotted, it will be found economical and advantageous to make up a fixture similar to that illustrated in the drawing.



Quick-Action Screw Slotting Fixture

The fixture consists primarily of the base plate G, the two half-sections A and B, and the wedge D. The screws are positioned between the half-sections and are locked firmly in position by movement of the wedge, which forces the half-sections endwise so that tapered recesses in the sides of the sections will bear against the rolls C.

The movement of the wedge D is governed by the cam-action lever E, which is moved by hand. Movement of the lever E in one direction swings the cam into contact with the end of the wedge D and forces it crosswise so that the half-sections A and B are driven endwise. Movement of the lever E in the opposite direction releases the wedge so that it can be forced backward by means of the lever F, thus releasing the half-sections A and B. The parts A and B can now be lifted out, the screws dumped out, and the sections refilled.

The base plate G is slotted along the center-line where the screws are located between the half-sections to permit the slotting of long screws. The use of V-slots for holding the screws will permit holding screws of different diameters, as long as all the screws in process at one time are of the same diameter.

Removing Obstinate Valve Seats From Crude Oil Pumps

By M. T. Pate

WHEN the valve seats on a battery of 6x24" triplex plunger pumps handling crude petroleum under an initial pressure of 800 pounds

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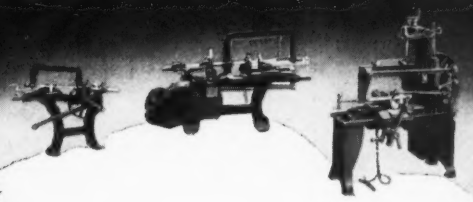

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p.s.i. finally gave out, the men in the pipeline company's station tried all kinds of improvised valve seat pullers without success, including those furnished by the pump manufacturers at time of initial installation.

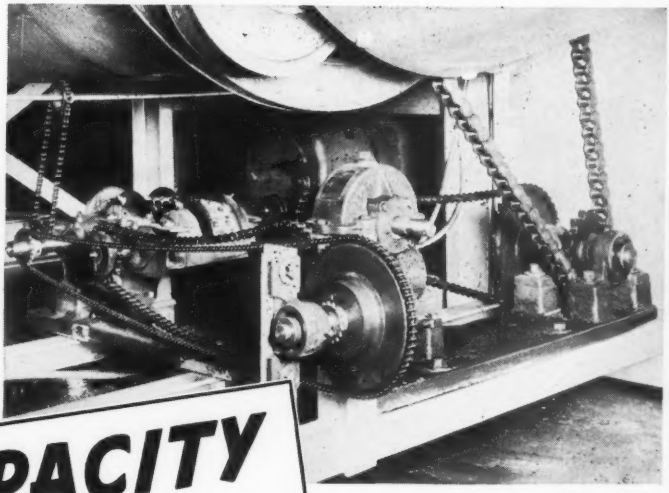
When pullers failed, the usual recourse of the pipeliner—the oxy-acetylene torch—was ruled out on account of serious fire risk, and the Oilfields Machine Company asked to submit a bid on the job of setting up a portable boring mill on the pump casting and cutting out all but a paper-thin shell of seat in this manner, after which the shell would be collapsed inwardly and pulled free.

The boring of these valve seats, slightly tapered in design and wedged home by the repeated impact of heavy ball valves over years of service, promised to be a tedious task and one involving risk of mutilating the pump casting when attempting to remove as much of the seat metal as possible.

After checking over the job carefully, the O.M.C. man hit on a possible expedient which, if successful, would eliminate the machining operation and greatly speed up the work.

Since the pipeline company had attempted to pull these valves with a threaded puller and a wrench with a six-foot extension handle on the puller nut, it is apparent that there is a theoretical force applied to the valve seat of stupendous magnitude. Actual computation showed a net force applied to remove the valve seat of over 72 tons—sufficient to pull the bolt in two. However, the O. M. C. man planned to remove the seats with a pair of small hydraulic jacks, with a rated capacity of 4½ tons, or 9,000 pounds lift.

With these figures in mind, the pipeline management was sceptical about the jack plan, but permitted a trial to be made. The sketch shows



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The solution:—a 4,000-lb. continuous rotary furnace with proper heat control, operated by a ½ horsepower motor through a variable and a constant speed reducer and various Baldwin-Duckworth roller chain drives at an average speed reduction of 4350 to 1. (Not shown in the above picture is the Baldwin-Duckworth continuous chain conveyor for removing the heat treated parts from quenching tanks at the discharge end of the furnace.)

This equipment was designed by Baldwin-Duckworth engineers to meet a specific requirement. The easy way, the low cost way, the best way is the roller chain way. Check into it. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

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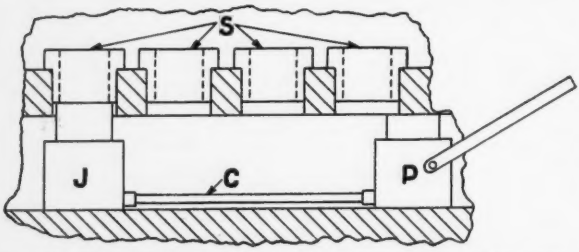
W-626

ESINOID, RUBBER AND SHELLAC BONDS

the essentials of the set-up, with the short jack—indicated as J—slipped in through one end of the pump suction or discharge chamber after removing the manifold connection. By centering the jack J under the seat to be pulled and setting the jack P at the end of the casting so that its ram would engage the pump casting between valve openings, it was possible to put up maximum pressure on the pump of jack P and to force this high pressure fluid through the connecting pipe C into the lifting jack J.



Drawing illustrating method employed to remove valve seats from crude oil pumps. S—Valve seats. J—Hydraulic jack. P—Jack used as pump only. C—Connecting pipe.

Although the rated capacity of the jacks was as given, a short length of pipe slipped over the pump lever doubled the actual pressure ratio, making available a lifting force of nine tons under the seat.

Although the theoretical force set up by the jacks was far below that computed for the screw lift, the hydraulic force was all available for the work at hand, while the energy put into turning the nut on the puller bolt must have been practically all absorbed in internal friction on the nut on the thread and the nut on the bridge over the valve chamber. That this friction loss must have been great was evidenced by the tearing of metal both on the nut and bridge in the areas under contact.

So effective was the plan of using two hydraulic jacks as shown that the seats were removed almost as fast as two men of the pipeline station crew could clear away manifold connections to give access to the pump cavities below the seats to be removed.

As it happened, the bore into which the seats were pressed was a scant sixteenth inch larger than the outside diameter of the jack ram, but for subsequent valve pulling jobs spacers of 1-inch boiler steel were cut to fit as closely in the seat bores, and to ride atop the ram. New seats were installed as fast as the old ones could be removed. On one pump, with 48 valve seats to be removed, the average time per seat was only 5.25 minutes, including the time that was lost when the connecting pipe burst and had to be replaced with a new one.

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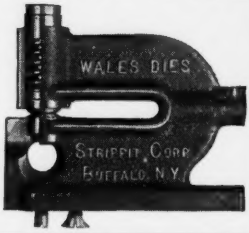

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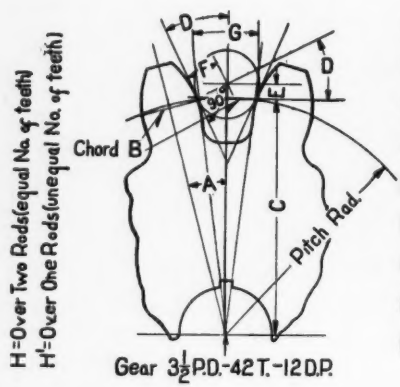

$A=\frac{90°}{\text{Teeth in Gear}}$	2°-8'.68
B = Sin. A×P.D.	.1308
C = Pitch R×Cos. A	1.7487
$D=14\frac{1}{2}+A$	16°-38'.58
$E=\frac{B}{2}$ Tan. D	.01956
$F=\frac{\frac{B}{2}}{\text{Cos. D}}$	.06831
G = 2F	.13662
H = 2C+2E+G	3.6733
$H'=C+E+F+\frac{\text{O.D. Gear}}{2}$ -----	

Calculations used in measuring the pitch diameter of a spur gear.

Measuring 14½-Deg. P. A. Spiral Gears with Rods and Micrometer

By J. J. HUBER,
Westinghouse Electric & Mfg. Co.

IN selecting a pair of spiral gears to be used as master gears, for which purpose the gears should be practically perfect, measurements were made by the use of a micrometer and rods. The method employed was based on the calculations presented in the drawings, Fig. 1 being that of a spur gear and Fig. 2 being that of a spiral gear. The initial calculations of a 45-deg. 12 D. P. (normal) spiral gear having 21 teeth are the same as for a spur gear 12 D. P. with the same number of teeth, as far as the normal pitch diameter is concerned.

In comparing Fig. 1 with Fig. 2, it will be noticed that the normal pitch diameter C of a 21-tooth 12 D. P. (normal) 45-deg. spiral gear is the

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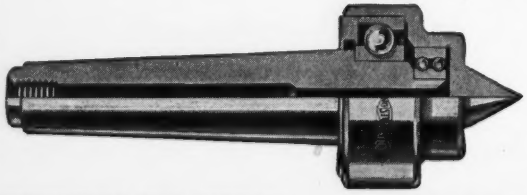

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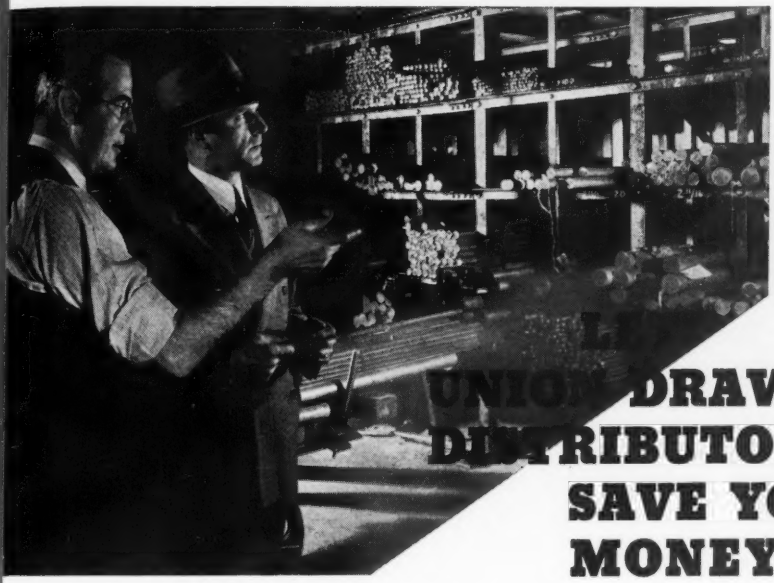

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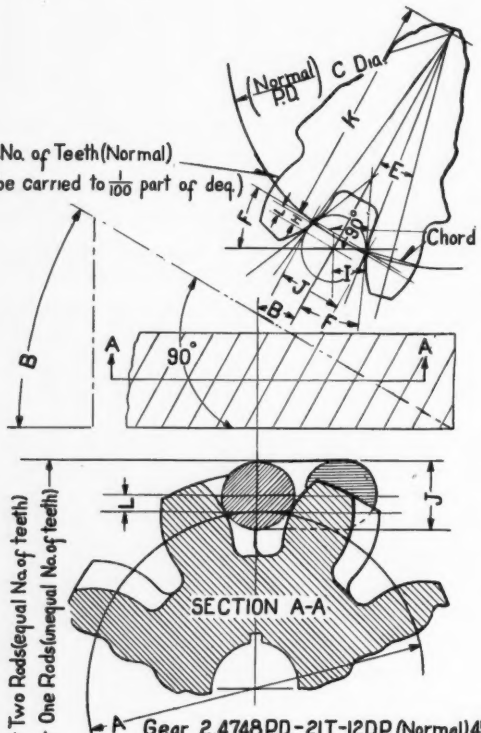
same as that of a 42-tooth spur gear, in consequence of which the same size rods are used in both cases. Naturally, the sizes of the pitch diameters of the gears.

The calculations are self-explana-



A = Pitch Dia.	2.4748
B = Angle of Spiral	45°
$C = \frac{A}{\text{Cos. } B}$	3.500
D = C x D.P. (Normal)	42
$E = \frac{90°}{D}$	2°-8.58
$F = 14\frac{1}{2} + E$	16°-38.58
G = Sin. E x C	.1308
$H = \frac{G}{2}$ Tan. F	.01956
$I = \frac{\frac{G}{2}}{\text{Cos.}}$	.06831
J = 2I	.13662
$K = \frac{C}{2}$	1.7487
$L = (K+H) - \frac{G}{2}$	.01826
M = A + 2L + J	-----
$M' = \frac{A}{2} + L + I + \frac{\text{OD Gear}}{2}$	2.6444

Calculations used in measuring the pitch diameter of a spiral gear.

the value of E of the spur gear would be the same as H of the spiral gear, but the value L will have to be taken into consideration in the spiral gear. This fact is due to the differences in

tory. In order to simplify the measuring, it is best to obtain the measurement of the turned outside diameter of the blank before cutting the teeth in cases where the finished gears will have an unequal number of teeth.

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Pat. Applied for.

Fig. 1334

Fig. 1249

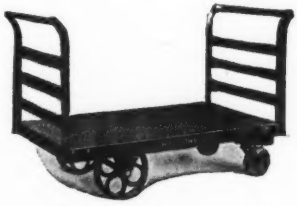

Fig. 754 Patent Applied For

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Fig. 732 Pat'd and Pat's Pending

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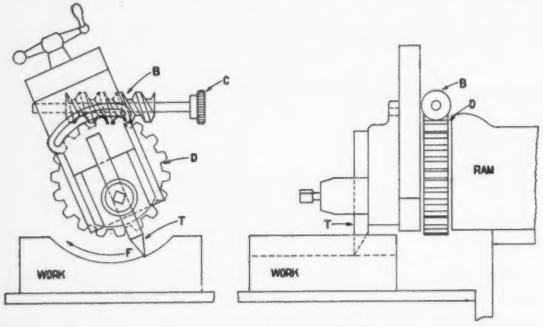
Shaping a Radius

By Rudolf Fischer

IN order to machine a radius in a number of work-pieces an attachment was designed with which the job could be done in a shaper as shown in the drawing herewith. The attachment consists primarily of a worm and wormwheel, the worm housed in a cylindrical housing (not shown) which was attached to the ram and the wormwheel attached to the head with machine screws and dowels.



Design of Attachment for Cutting a Radius on the Shaper.

In the drawing the worm is indicated at B, the wormwheel at D, and the handwheel by which the worm is revolved at C. With the work properly located and clamped in the vise and the tool T in position, the handwheel C is given a slight turn between cuts in the same manner as any other hand feed. The accuracy of the job depends, of course, upon locating the work so that the ram will be central, the correct radius depending on the setting of the tool. This job could have been handled just as easily in other machines, such as the boring mill, for example, but the boring mill was overloaded, while the shaper was practically idle. In such cases this attachment will perform efficiently and accurately.

Bronze Bearings. Catalog 137, issued by the Buckeye Brass & Mfg. Company, 641 Hawthorne Ave., Cleveland, Ohio, comprises a complete listing of the various types of Buckeye Bronze Bearings together with prices and specifications. Copy of the catalog free upon request.

Century Fractional Horsepower Motors. The purpose of this 24-page bulletin which has been prepared by the Century Electric Co., 1806 Pine St., St. Louis, Mo., is to present, in helpful form, information concerning the electrical characteristics of fractional horsepower motors and to suggest how these characteristics can be most effectively applied to motor driven machinery and appliances. A number of types of the fractional horsepower motors produced by the Century Electric Company are described and illustrated. Copy free upon request.

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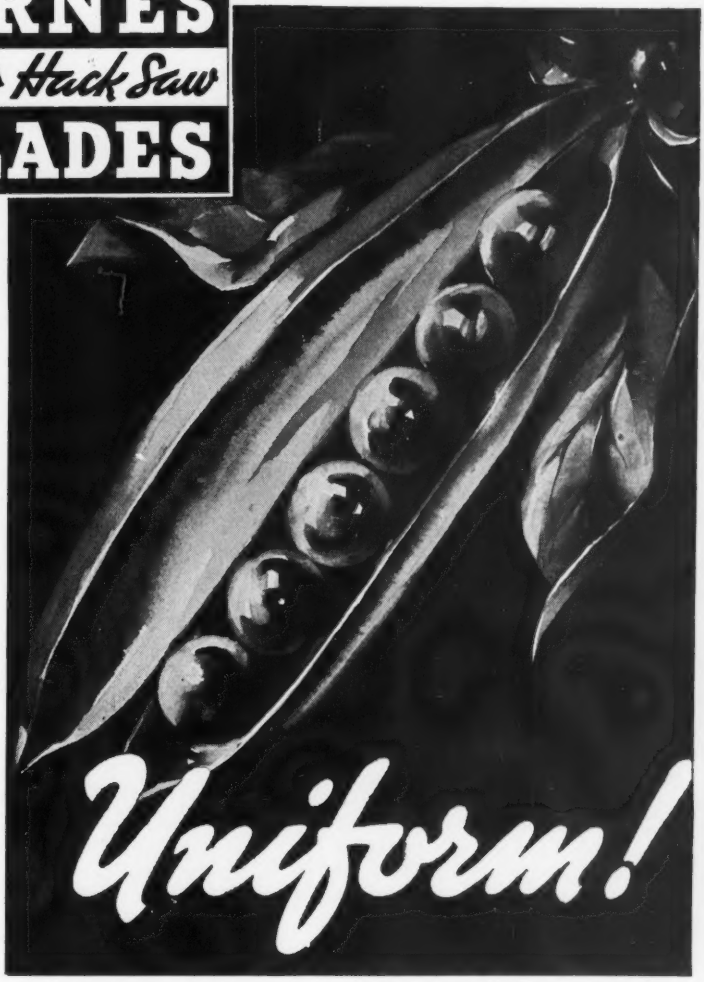


As like as peas in a pod—as uniform as balls in a bearing race—that's the Barnes "Red Arrow" Blade. Made of genuine high speed steel, heat treated and tempered under absolute electric control, "Red Arrows" assure the maximum of cutting efficiency. There's a distributor near you to supply your needs.

W. O. Barnes Co. Inc., Detroit, Michigan

Over the Editor's Desk

Noise

EVERYONE has his pet theories, and we have ours. One of them concerns the effect of noise on the human nervous system and thus on quality and quantity of production, the ability to withstand mental and physical fatigue, and so on. Several years ago we made an effort to obtain some data on the subject, and found that outside of a few studies by Professor Donald A. Laird of Colgate University, practically nothing concrete had been done along this line.

This month we are privileged to present a paper on this subject by an engineer who has made the study of sound both a hobby and a business —E. V. Sundt of the Sundt Engineering Company. Bearing out our previous statement, note that all of the references quoted in the Bibliography at the end of the article are dated 1930 or later. We are beginning to discover that noise is not only disagreeable and uncomfortable, but is also costly.

We hope to have another article on this subject in the near future, in which will be presented case studies of production records in noisy and in quiet areas.

A Bow

WE were pleasantly surprised at the number of letters that came in commenting on our editorial in the December number of this magazine on "Communism". And at the apparently large number of people who also seem to feel that attempts to eliminate the problem by suppressing all references to the subject are both un-American and unintelligent. The solution lies in education, and while we are educating our youth in theories of government we must not neglect his education in human nature. Angels might operate a Communistic state successfully, but the average human being is not an angel—yet.

Writers

OUR editors have travelled in many states this past year, inspected many plants, and "met up" with many friendly people. That is the best part of our job—meeting people and seeing how they handle their work. Another part of the job consists in describing some of the interesting things we saw in these plants, in articles similar to this month's feature article on the A. C. L. Shops at Tampa. But we never feel that we have described the plant or its tools as well as they could have been described by some one of the plant executives, and we are continually surprised at the number of men who seem to think that writing a descriptive report requires some kind of special training. Not so. Nor are we partial to experienced writers. We want ideas, and as long as we can understand what the writer is talking about, we will be satisfied. Ideas are more important than smooth writing, although good composition helps. We will attend to the punctuation, if any is needed. If you have an idea or a suggestion, send it in. Everything accepted is paid for at prevailing market rates.

PATENTED TOOTH CONSTRUCTION

Only the Nicholson File Company makes files with reserve cutting edges that go to work as old ones wear down. And you can see the difference in the Patented Tooth Construction that makes possible this unique advantage.

The top edges of the tooth points are irregular .. the patented principle of controlled serrations. This is the feature that sends in fresh reserves of cutting edges to keep on working at full efficiency when old style files are ready for the discard.

Old style files cost up to 40% more to use than files with the new patented tooth construction. That's a vital reason for using the only files which have the new Patented Tooth Construction. Nicholson, Black Diamond, McCaffrey. At mill supply dealers' and hardware wholesalers'. Nicholson File Co., Providence, R. I., U. S. A.

A FILE FOR EVERY PURPOSE

New Shop Equipment

Fellows Rack Shapers

The Fellows Gear Shaper Company, Springfield, Vermont, has announced two new rack shapers designated as Nos. 3-48 and 3-60. These machines, which are arranged for cutting spur and helical tooth racks, are identical except for length of rack that can be cut. The No. 3-48 machine will cut rack lengths up to 48 inches, and 3 inches face width; whereas, the No. 3-60 will cut rack lengths up to 60 inches.

The rack shaper is of extremely rigid construction. The base is of heavy box section, and carries a table mounted on ways and actuated by a lead screw and change gears. The bed is mounted on a similar box section base, located at right angles to the base carrying the table. The position of the bed, when the cutter is in action on the work, is controlled by a feed cam which, in conjunction with change gears, controls the depth of cut and the depth feed per stroke of the cutter. The saddle carrying the cutter-spindle is of the "relieving" type, and is mounted on substantial trunnions supported in the bed and actuated by a positive and smooth-operating relieving mechanism.

Operation of the machine is greatly simplified by employing a complete electrical control, comprising push buttons and selector switches can be set by the operator so that the cutter can be operated from either end of the rack or in the center of the rack, and control the depth feed and traverse feed motions of the machine, as well as stopping the machine when the rack is completed.

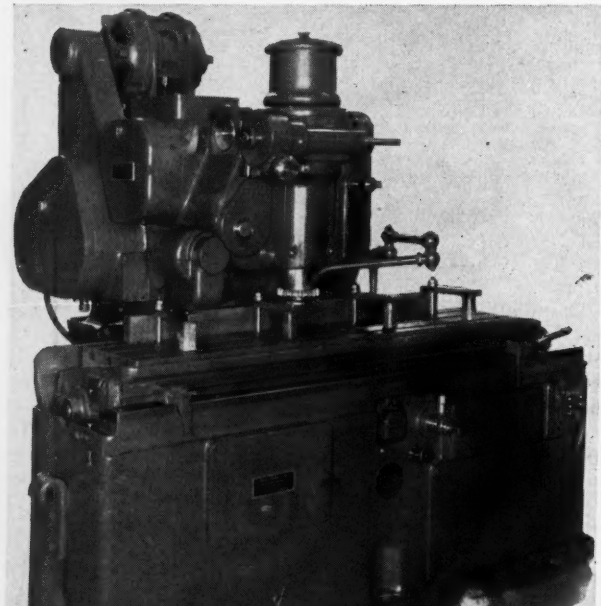


Fig. 1—Front view of Fellows Automatic Rack Shaper

The machine can be used to finish a rack in either one or two cuts by the setting of the selector switches, and operates automatically for the second cut without any attention on the part of the operator. That is, at the completion of the roughing cut, the cutter is automatically fed in to finishing depth, then the depth feed is disengaged and the traverse feed engaged to traverse the rack table in the opposite direction.

Various safety features are included in the machine to protect cutter, machine, and operator. The machine is equipped with four motors: the main motor which operates the cutter spindle, etc.,

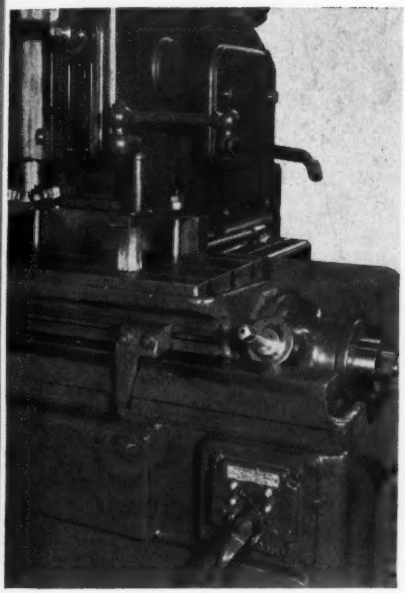


Fig. 2—Close view showing cutter, work, speed control lever, push button control, etc.

compound pump motor, depth feed motor, and traverse feed motor. All motors are under the control of the selector switches and push buttons.

Cataract Open Cone Style Precision Bench Lathe

The Cataract Precision Bench Lathe with preloaded ball bearing spindle construction made by Hardinge Brothers, Inc., Elmira, N. Y., is now offered in the open cone style. The accuracy at high speeds which is expected of a lathe of this type is ensured by the use of the Super-Precision Duplex Ball Bearings with preloading, and the bearings require no adjustment.

The headstock frame is of fine grade seasoned and heat treated alloy iron and has a hand-scraped bearing surface to fit the ways of the bed. The spindle is hardened and ground, both internally and externally, and is of the best grade ball bearing steel. With the ball bearing construction, the spindle is mounted in rotating members to eliminate wear. The spindle cone pulley is provided with four holes for locking and 60 holes for indexing. The Hardinge patent taper nose is provided on the spindle unless a threaded nose is requested.

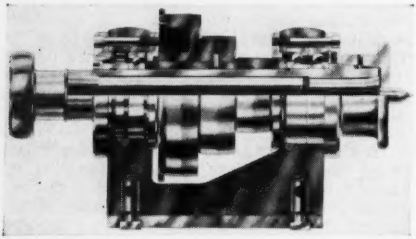
In the manufacture of preloaded bearings, the clearance between the inner rings is calculated by the bearing manufacturer to produce a predetermined initial load for bench lathe purposes. In the Hardinge installation a locking nut is turned which pulls the inner races together and automatically secures the proper initial load for correct spindle rigidity. The balls have an angular contact so that they rotate as they roll, thereby presenting ever-changing bearing points. When external or work load is applied to the bearing, the preload is reduced according to the amount of the external load and the effect on bearing endurance is negligible. The preload on each ball gradually absorbs the work load and returns to the normal preload, thus assuring quiet operation and forming the basis for smooth turning cuts.

All end thrust, as well as radial work load, is taken by the front bearings with the single row rear bearing acts merely as a steadying support. The whole spindle assembly is in inherent balance to eliminate any undue vibration even at the highest speeds.

The front bearing section is lubricated through a cup located at the rear of the headstock. The rear bearing is greased and sealed for life, requiring no additional lubricant. Both bearing sections are sealed with cork seals to exclude dirt and other foreign matter.

Cataract Open Cone Style Precision Bench Lathe

The construction described above permits the proper cutting speeds for machining the smallest size to capacity.



Cross Section of Headstock Showing Construction.

Perfect finish is obtained without polishing, and tungsten carbide and diamond tools can be used to their fullest advantage. Absence of vibration is an outstanding feature of the machine. The absence of radial play and end play makes possible the closest accuracy. The machine is proportioned to assure rigidity, smooth performance and long life.

A wide variety of interchangeable attachments are available for this lathe.

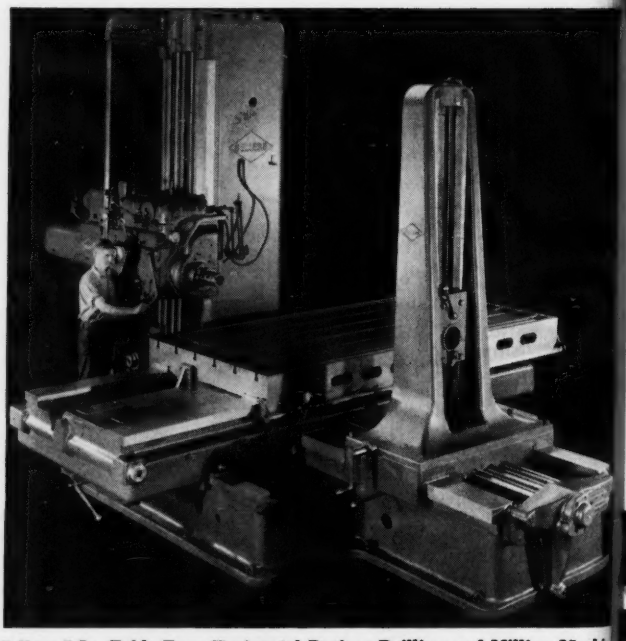
ordination of simplicity with many highly developed proved details of design.

Convenience, flexibility, productivity and precision are the features of Sellers Unit Head, which is a complete power unit with the motor mounted on the head. Power is transmitted through a direct spur gear drive from the motor to the spindle. Only four levers are required to control the operation of the machine and the operator can reach all controls from his normal working position at the spindle. Controls centralized on the head include feed and power traverse, spindle forward and reverse, spindle directional control, feed selection, speed selection, hand adjustment for setting spindle, head, saddle and table. All feeds are applicable to all spindle speeds.

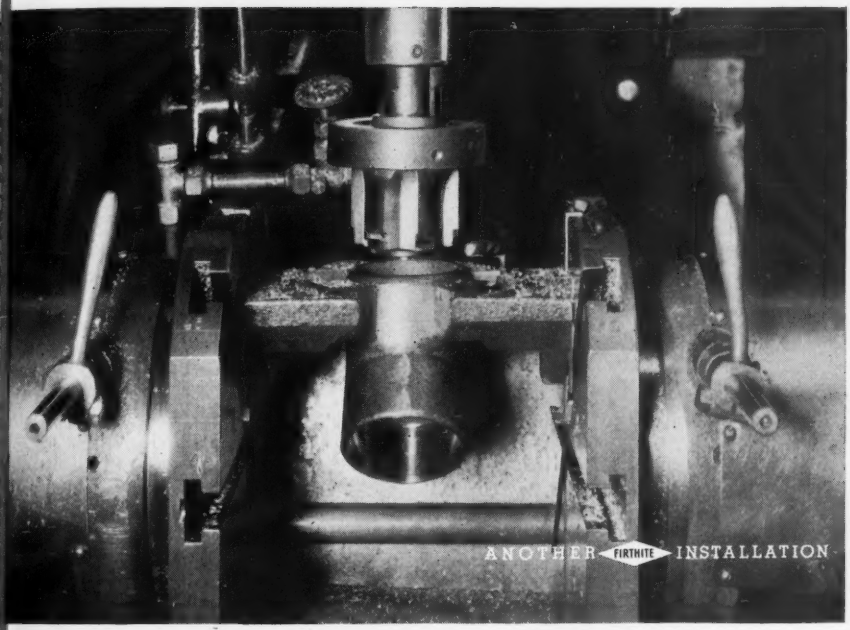
The spindle is 5-in. diameter and has a Morse No. 7 taper. The spindle feeding stroke is 36 in. Twenty-four spindle speeds are available ranging from 5 to 334 r.p.m. There are 24 feeds to the spindle, head, table and saddle, ranging from 0.0025 to 0.625 in. per revolution of the spindle. Maximum distance from center of spindle to top of table is 6 in. Size of table, 60x120 in. Width o

Sellers 5-In. Table Type Horizontal Boring, Drilling and Milling Machine

The illustration shows the No. 504 Type C 5-In Table Type Horizontal Boring, Drilling and Milling Machine which has been brought out by William Sellers & Company, Inc., 1600 Hamilton St., Philadelphia, Pa. The machine is designed to meet the most exacting requirement of the manufacturing plant or tool room. It is evident that every modern feature in machine tool design has been considered in the design of this machine and the result is a co-



Sellers 5-In. Table Type Horizontal Boring, Drilling and Milling Machi



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In a large plant using FIRTHITE on 85 per cent of all boring, turning, milling and reaming operations, the Works Manager says, "FIRTHITE is the most economical cutting material available." The FIRTHITE Tool shown above, boring heads of large cast-brass pipe fittings, has six FIRTHITE teeth that finish the bore to size, and one adjustable FIRTHITE Tipped blade that faces and forms the edge of the casting.

This boring is done at:
Speed of 400 feet per minute.
Production 5000 pieces per grind.
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This FIRTHITE Tool set-up is just one of many hundreds of Profit making FIRTHITE installations. Consult us for specific information on possible FIRTHITE applications in your shop.

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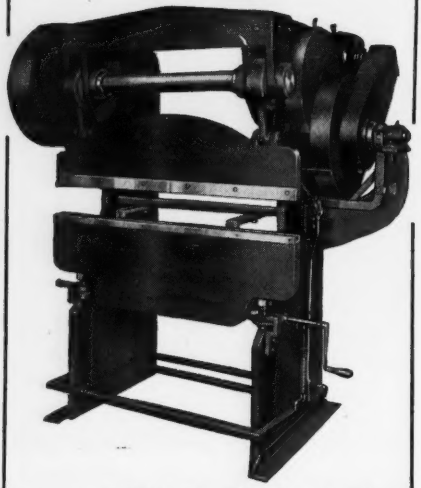
CHICAGO STEEL PRESS

No. 253



Does 40% to 60% of the forming work turned out by the average shop.

Here's a profitable, economical brake ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes, and a great variety of sheet metal specialties. Its variable speed drive operates from 17 to 50 strokes per minute. The No. 253 CHICAGO STEEL PRESS is accurate, compact, and ruggedly constructed of highest quality materials.

Sizes 4, 5 and 6 ft. capacities, up to 10 gauge.

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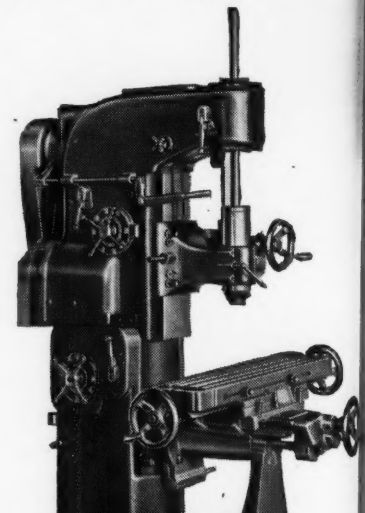
CHICAGO ILLINOIS

bed across ways, 108 in. Size of colu at bed, 40x43 inches.

Precision measuring equipment c sists of two sets of dial indicators, crometer and V-bars with adjusta stops for pin gages, but not includ the gages. The machine is equip with a coolant system with motor driving the pump, also with a chip with supporting pins in the saddle a chip deflector. Electrical equipm includes one 15 h.p. A.C., 1750 r.p three phase, 60 cycle, 220 or 440 volt squ rel cage constant speed motor, also mo mounted solenoid brake rated for a half torque of motor. Motor to be commercial dynamic balance and co plete with one non-reversing magn starter with separate start and stop p button station.

No. 30 Knight Miller

A universal vertical milling mach designed to make available the ma mum amount of rigidity, power, ac



No. 30 Knight Miller

racy, versatility, and speed has b developed by W. B. Knight Machin Company, 3920 W. Pine Blvd., St. Lo Mo. To insure rigidity and power,

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In Danly Dowel Pins, Cap Screws, Springs and other items you find close accuracy in manufacture, and other qualities that mean money saved in their application and in their use.

Dowel pins accurate to ±1/10,000 and of uniform straightness end to end.

Knurled Socket Head Cap Screws are driven home faster and easily locked.

Stripper Bolts are absolutely accurate in their standards and will not work loose.

Springs coiled from the special keystone section wire, with strength and clearances uniform inside and out.

Precision Guide Posts and Bushings —are the same as used in Danly Precision Die Sets.

Clamps of Forged Steel for less than the cost of a plain steel block can be cut to size and drilled.

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DANLY DIE MAKERS' SUPPLIES

integral cast, heavily reinforced, semi-steel column is used to support the table and spindle units through wide, long and accurately fitted bearing surfaces of each part to the others, and by the use of a forged chrome nickel steel spindle, driven by hardened, ground and lapped spiral bevel gears. The change gears are of heat treated alloy steel, mounted on anti-friction bearings, and run in oil. The table unit is of the semi-bed type and is rigidly supported at the outer end of the knee as well as at the column. The saddle is 20 in. long and 14 in. wide with large bearing surfaces giving the table rigid longitudinal support.

Among the features which insure accuracy are the fact that the forged chrome nickel spindle is accurately ground all over and mounted on precision preloaded taper roller bearings. The spindle sleeve is 4⅝ in. in diameter with a 6 in. closely fitted bearing in the spindle head which, in turn, has a 12x8 in. wide accurately scraped fit to the face of the machine column. All bearing surfaces are wide, long and accurately scraped to surface plates.

Sixteen spindle speeds are available in geometrical progression from 80 to 1600 r.p.m. There are also 16 table feed changes in geometrical progression, a of which is designed to maintain versa tility.

The real speed of the miller, howeve is said to lie in the short time require to make set-ups—particularly difficu ones—the quick and accurate locatio of holes and surfaces, the quick chang of vertical settings by moving the spin dle instead of raising or lowering th work, and the fast method of changin cutting tools.

Disengaging the clutch operates th brake, stopping the spindle immediate for quick cutter changes. Power transmitted by means of a short V-be drive to a twin disk clutch. Quic operating and easy reading dials are pro vided for selecting speeds and feeds.

All vertical adjustments are obtaine by moving the counterbalanced spindl and spindle head. Positive and auto matic throw-outs are provided for spin dle feed in either direction. The tabl tilts to either side of horizontal, th tilting being done by means of a worm screw with graduations indicating th degree of tilt. The table unit swivel around the column, increasing both lon gitudinal and throat range.

The table travel, longitudinal powe feed, is 25 in.; transverse power feed, 1

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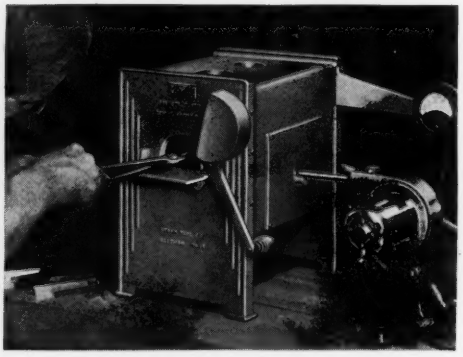


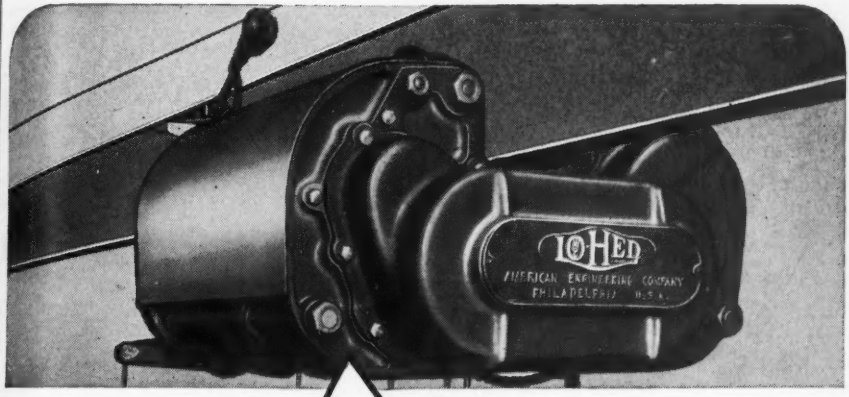
Operates at 7c per hour or less on natural, artificial or tank gas. Full muffle type. Attains 1800 degrees in 20 minutes.

Also perfectly adapted for clean hardening of high speed and carbon tools. Range 1300-2400° F.

The "STARK" *Electroblast Hydrogen Brazing Furnace*

Price, ready to use as shown (except hydrogen tank) $198.00 f.o.b. Waltham

STARK TOOL COMPANY, Waltham, Mass., U. S. A.



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Specify *THE* hoist with the highest factor of safety!

Let the nearest A-E-CO representative show you why A-E-CO Lo-Hed HOISTS are the safest hoists built.

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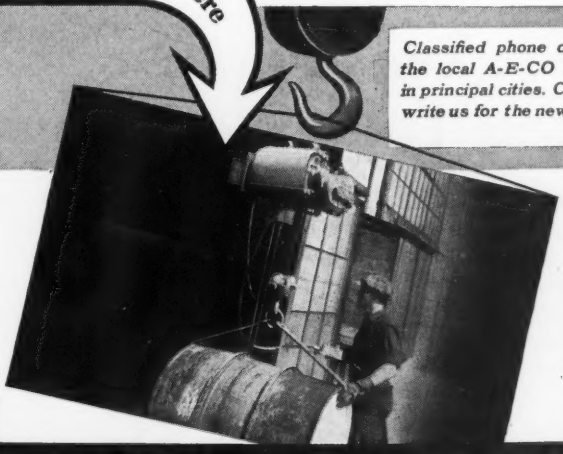
Find out *why* Lo-Hed is the logical hoist for EVERY purpose and why it is the *only* hoist for low headroom conditions. A-E-CO Lo-Hed HOISTS are built in 98 standard models—from 1/4 to 12 ton capacities.

Classified phone directories list the local A-E-CO representative in principal cities. Call him in... or write us for the new hoist catalog.



A-E-CO Lo-Hed HOIST

AMERICAN ENGINEERING COMPANY

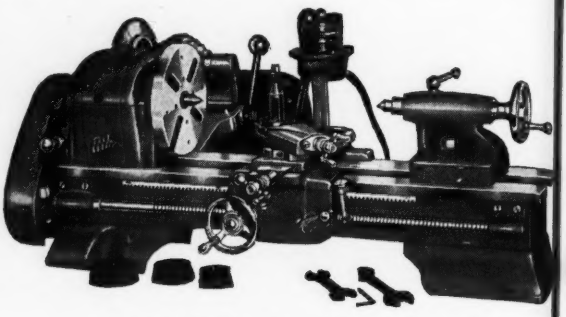
2451 ARAMINGO AVENUE, PHILADELPHIA, PA.

in. Maximum distance, table to spindle, including adapter, 20 in. Dimension, face of column to center of spindle, 12 in. Spindle head travel on column, 14 in. Spindle travel in head, 6½ in. Overall size and working surface of table, 10x42 in. Distance, floor to top of table, 33 in. Floor space required. 70x86 in. Height, 100 in.

Atlas Back-Geared Screw-Cutting 6-In. Lathe

The newest addition to the line of machine tools made by Atlas Press Company, 1146 N. Pitcher St., Kalamazoo, Mich., is the back-geared screw-cutting 6-in. precision lathe illustrated herewith. The lathe swings diameters up to 6 in. and is available in two bed lengths of 12 in. and 18 in. between centers.

Features of design that insure accuracy and efficiency on larger machine tools have been scaled down and applied to this lathe. Including among the modern construction details of the lath are reversible power feeds for the car riage, complete V-belt drive, Timke



Atlas Back-Geared Screw-Cutting 6-In. Lathe

tapered roller spindle bearings, integr countershaft, and careful provision manufacturing and construction f maintaining permanent accuracy. The are 16 speeds available and threads ca be cut from 8 to 96 threads per inc right or left hand. Standard equipmen includes a complete set of change gea and the necessary wrenches.

an Announcement—

CARL ZEIS JENA

Zeiss Precision Gauging Tools and Instruments

Effective immediately, the distribution and servicing of Zeiss Industrial Measuring Instruments will be handled by ourselves direct from our New York Office. Many of these instruments are on display in our showrooms, and experts will be glad to discuss with you the measurement and inspection problems of your production, toolroom or laboratory. Requests for literature, consultation and correspondence are cordially invited.

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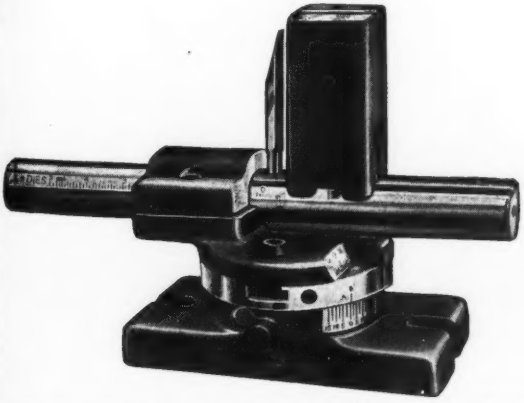
Accurate chaser grinding CUTS THREADING COSTS!

To users of self-opening die heads and collapsing taps, the Geometric Style E Universal Chaser Grinding Fixture brings savings through longer chaser life, the elimination of breakage and spoilage, and improved accuracy of work. Chasers that are correctly and uniformly sharpened long outlast dull chasers, and produce smooth, clean threads. This simple, compact, inexpensive fixture handles all types of conventional chasers—milled die head chasers, tapped die head chasers and collapsing tap chasers. Cut your threading costs and increase the efficiency of your threading tools with this universal grinding fixture.



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THE GEOMETRIC TOOL CO.

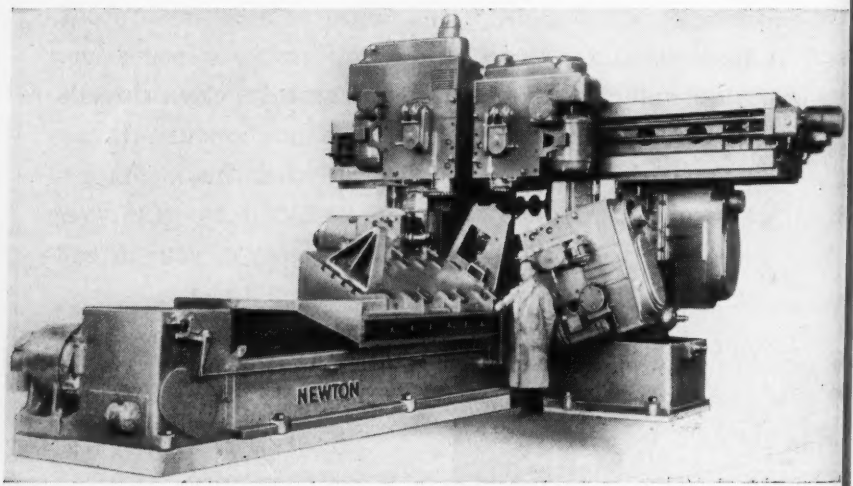
NEW HAVEN, CONN.

Send Style E Fixture Booklet to—

Newton L-76 Milling Machine

The Newton Division of Consolidated Machine Tool Corporation, Rochester, New York, has designed and built a large straight line milling machine that does all the surface milling and also bores cylinder seats on large Diesel Engine Crank Cases. Employing the new Newton box type unit head construction, this machine has the flexibility, versatility and precision that permits machining straight 8, V-12 and V-16 Cylinder Crank Cases.

Simplicity of control, ease of adjustment, convenience of making speed and cutter changes, have all been carefully worked out so that this huge machine handles as easily as a small machine tool.



Newton No. L-76 Milling Machine

Basically, the machine consists of five milling heads and one boring head. Two swiveling millings heads are mounted on front upright, two swiveling milling heads on front face of cross girt and one non-swiveling on rear upright. An outboard bearing is provided on rear cross girt for supporting horizontal cutter arbor. A swiveling boring head is mounted on rear face of cross girt.

Unit milling heads are of standard Consolidated construction with spindle mounted in Timken Bearings, and arranged for individual motor drive through suitable reduction gears, including flame-hardened herringbone gears for the final drive and a pair of pick-off speed gears, which can be transposed or changed for varying the cutting speed. Each head is adjustable on its support and spindle quills have in and out movement for positioning by means of motor mounted on head, and also have hand adjustment. Boring heads like other heads is mounted in Timken Bearings. Rapid traverse of boring bar is by separate motor mounted on head. Quick feed changes are accomplished by means of lever convenient to operator.

Table feed is from adjustable speed motor connected to gear box with clutch for selecting between rapid traverse and feed and transmitted through large diameter coarse pitch screw operating in nut bolted to underside of table. Table is so interlocked that it cannot be moved when boring bar is down.

Provision is made for take-up on all spindle bearings, and all slides are gibbed for maintaining proper alignment. Micrometer dials are mounted on each head for precision positioning. Cutting coolant is supplied to various cutters through a motor-operated pump.

Table ways and feed gears are lubricated by motor driven pump located at end of bed. Each head has forced lubrication to gears and bearings provided by

Announcing

NATIONAL HEAVY DUTY

COUNTERBORING TOOLS

The NATIONAL Spline Taper Drive Counterbore and its companion tool, the Spline Drive Inverted Spotfacer, combine Simplicity of Design with Ruggedness. Permanent Alignment, Interchangeability and exceptionally Long Life.

Special Engineering Service for handling adaptations to the special or unusual jobs. *Standard sizes in Stock.*

Note the Simple, Rugged construction of the Spline Taper Drive (above).
Send for the new NATIONAL Catalog of Heavy-Duty Counterboring Tools.

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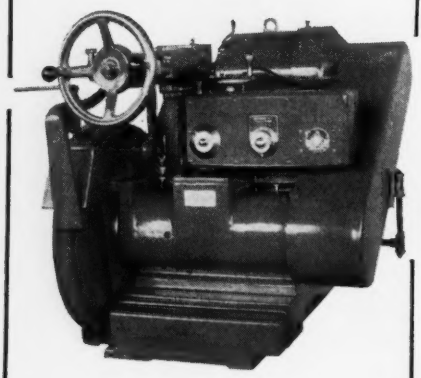
The BOWGAGE

INDEPENDENT GRINDING WHEEL HEAD



A self-contained unit hydraulically operated with an automatic grinding cycle —with DIMINISHING FEED. Can be applied to most any plain grinder.

Weight 1900 lbs. Takes wheels 24"x2"x12" — 20"x 4"x12".

•

FITCHBURG GRINDING MACHINE CORP.

Fitchburg, Mass.

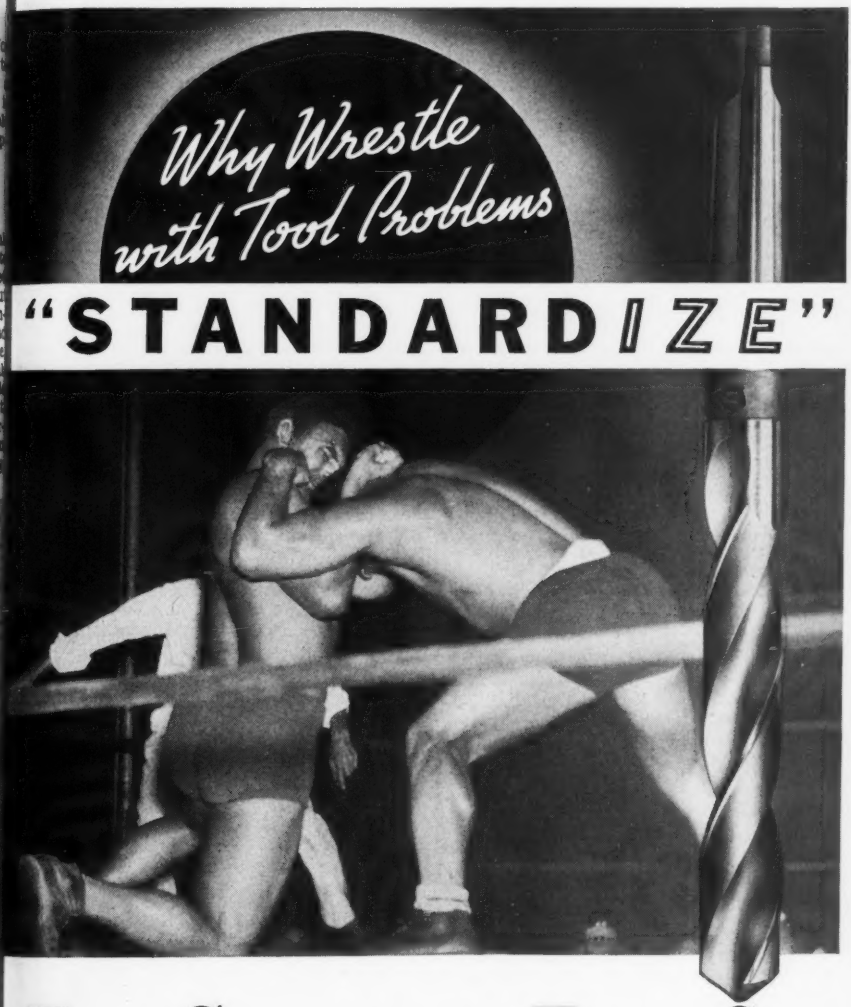
a pump located in the head.

There are eighteen motors required f this machine ranging from ¾ h. p. 30 h.p. Table is 17 ft. long and has travel of 25½ feet. Width of table 5 ft. Distance from crossrail to tab 5 ft. 3 in. Weight of machine is ap proximately 250,000 pounds.

U. S. Multi-Miller No. MM-2

A milling machine designed for clim milling and milling of small intricat parts on a producton basis, designate as the No. MM-2, has been brought ou by the U. S. Tool Company, Inc., Am pere, East Orange, N. J. Accuracy an versatility are features of the machin the machine being intended for clim milling where the cutter teeth and tabl have the same direction of movemen continuous milling, rotary milling, ver tical milling, conventional milling, spu gear cutting, and high speed grindin

U. S. Multi-Miller No. MM-2



"STANDARDIZE"

THE STANDARD TOOL CO.

Cleveland

NEW YORK • DETROIT • CHICAGO

TWIST DRILLS • MILLING CUTTERS • TAPS • DIES • REAMERS
DRILL CHUCKS • WHEEL DRESSERS • SPECIAL TOOLS

Intricate cuts are said to be possible on the Multi-Miller automatically and with the maximum of accuracy and production capacity.

An outstanding feature of the machine is the cam method of controlling table movements. Where a cut is to be made to a prescribed depth, the table movement of the Multi-Miller can be set to repeat the desired cycle indefinitely without variation. Eight cutting speeds are obtainable from each cam and the total time for the complete table cycle can be arranged for from five seconds to two minutes. The cam method permits correct table speeds to be used at all parts of the cycle, approach, cutting and return speeds being easily established to meet the requirements of the job.

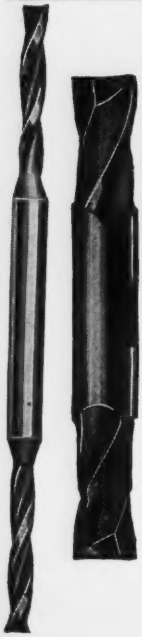
The table is driven by means of a cam-operated sector which engages a rack. For ordinary milling the table is moved to the cutter as the radius of the cam increases and exerts pressure on the cam roller. In this case the table return stroke is provided by a table return counterweight. For climb milling, the table is moved to the cutter by reversing this weight, the change of cam contour determining the movement. As the radius of the cam diminishes, the table counterweight forces the tabl ahead, the change in radius determin ing the amount of table movement.

The Multi-Miller can be adapted to wide variety of applications. Notar attachments make possible intricate ro tary cuts; a rotary table enables th machine to operate as a continuou miller; bar or coil stock can be form milled continuously; high speed grind ing heads can be applied for precisio grinding of narrow slots and other fin work.

Haffling Power Screw Driver

To meet the needs of manufacturer of electric shavers, electric clocks, an other electric mechanisms involvin difficult assembly jobs. the power scre driver illustrated herewith has been de veloped by E. V. Haffling Co., Inc., Remer St., Bridgeport, Conn. The featur of the machine consists in that onl the amount of tension required to driv the screw need be applied, eliminatin danger of splitting the delicate parts.

The machine is of the vertical typ of construction with a horizontal arm carrying both the spindle, which is vert ical, and the driving motor. The moto is 1/60 h.p., reversible, 60 cycle, A.C



END MILLS
for
all purposes

You can be sure of accurate and economical service from Progressive Shear Cut End Mills. Careful attention is given to insure their accurate workmanship and the quality of all materials.

Take advantage of our years of experience and let us help you on special end mill jobs.

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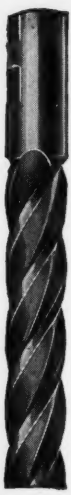


IN SMALL DRILLS AND LARGE DRILLS, MORSE QUALITY STANDS FOR PRODUCTION EFFICIENCY . . . REGARDLESS OF SIZE, YOU CANNOT BUY A BETTER DRILL THAN MORSE

MORSE THERE IS A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE STREET - - - CHICAGO STORE: 570 WEST RANDOLPH STREET

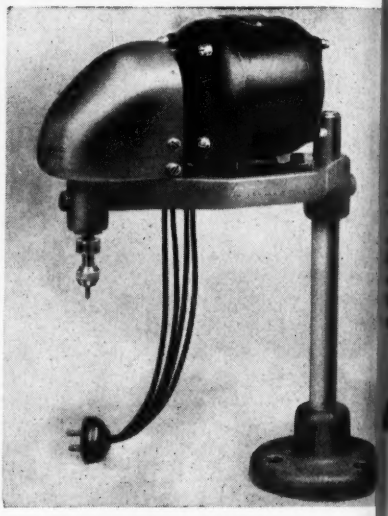
The wheel in a RIDGID is a thin blade, coined out of alloy tool steel, hammered, heat-treated, assembled in a solid hub. Gives you far more cuts per wheel. Assures quicker easier cleaner cuts, practically no burr. Reinforced cutter housing guaranteed not to break or warp, always cuts true. Try one at your Jobber's. Find out why hundreds of thousands of users take pride in owning the RIDGID. For economy and better cutting, buy the better looking RIDGID.

The Ridge Tool Company Elyria, Ohio

RIDGID
PIPE TOOLS

1725 r.p.m Power is transmitted fr the motor shaft to the spindle mating friction disks and the spind is in operation only when the disks in contact.

The tension necessary to drive t screws is obtained through an adjustab clutch which can be set so that t operator is enabled to drive screws in the work at whatever tension is desire Thus the exact amount of tension ne essary to drive the screws can be o tained without necessity of extra pr



Haffling Power Screw Driver

sure which may damage the work. Wh it is desired to drive the screw only certain depth, a balance wheel on t spindle can be adjusted to obtain th result. The height of the machine approximately 13 in. and the dimens from center-line of spindle to cente line of column is 7¼ inches.

Colonial Standard Universal Broaching Machine

Bearing seats in automobile engi are now being broached with the equi ment shown in the accompanying ill tration. The machine is a standa Universal Broaching Machine built Colonial Broach Company, 147 Jos. Ca pau Ave., Detroit, Mich., with fixtu built up on a separate base, bolted the face plate of the machine.

Are you A SUPER-CRITICAL JUDGE OF Flat Wire?

IF you are, you have much in common with our customers—men who buy cold rolled steel flat wire to very exacting specifications.

To be brief, our specialty is making cold rolled steel flat wire...high and low carbon...to meet severe requirements. It is not a "bed of roses" business, for our customers demand exceptionally close adherence to strict specifications. It calls for a high degree of skill and experience; custom production methods of steel making, rolling and heat treating; close attention to many details; and team work to the nth degree.

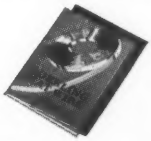
High fatigue resistance, great flexibility, uniformity of temper, dimensional accuracy, and ability to withstand severe drawing strains. These are but a few of the qualities which are demanded in the comprehensive variety of flat wires we make.

—

We would welcome an opportunity to serve you—and to furnish further information, samples or prices.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

Roebling COLD ROLLED STEEL FLAT WIRE



John A. Roebling's Sons Co.
(Mail to Trenton, New Jersey or nearest office)
☐ Please mail me copy of your Flat Wire Catalog
☐ Have your representative call.

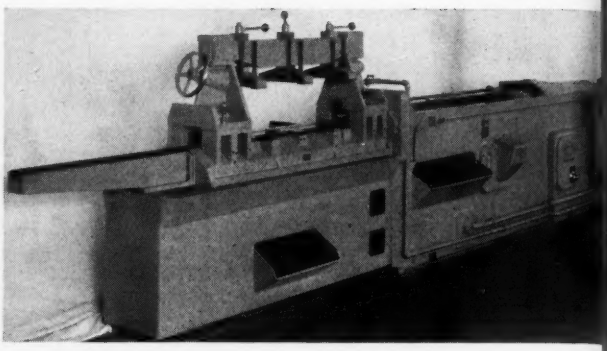
Name.....
Company.....
Street.....
City and State.....

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

The machine is so designed that the cylinder blocks can be slipped into place directly from the roller conveyor on which they travel without requiring handling with chain hoist, etc. The blocks are located over dowel pins and are clamped from the end and top.

Broaching is completely automatic, the broach being pulled through the block with a 60 inch travel of the broach heads. The ram has a capacity of ten tons, about 1/32 in. stock being removed to completely finish the bearing seats to close tolerances.

The machine is provided with variable speed adjustment and high speed return, providing a production of about 60 blocks per hour including loading and unloading time. Note the extension support for the broach bar on the base of the fixture.



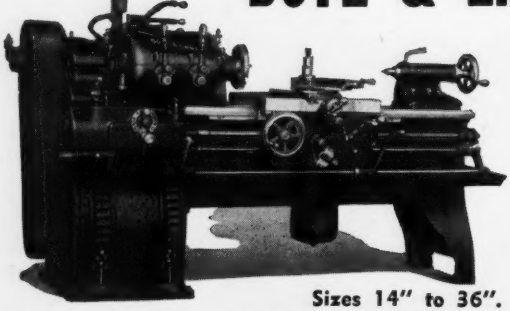
Colonial Standard Universal Broaching Machine

1938 Model South Bend 9-In. Workshop Precision Lathe

The 1938 South Bend 9-in. Worksh Precision Lathe is announced by t South Bend Lathe Works, South Ben Indiana. The new model has ma important new features, and is offer in seven different types to fit a varie of installations.

The lathe is regularly equipped to c

Smooth - Powerful - Accurate
BOYE & EMMES LATHE



Sizes 14" to 36".

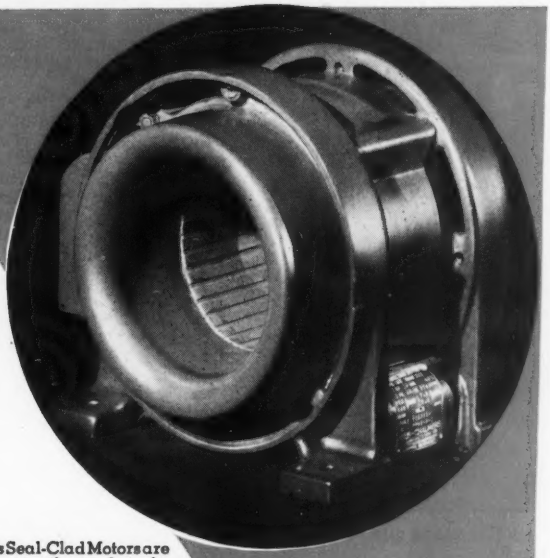
BOYE & EMMES Lathes will deliver the finest kind of lathe performance you've ever known, and they'll keep on delivering year after year. That's the result of experienced engineering . . . quality construction . . . and strict attention to every detail.

Write today for complete information.

THE BOYE & EMMES MACHINE TOOL CO.
CINCINNATI OHIO

"The Lathe With The Longer Life"

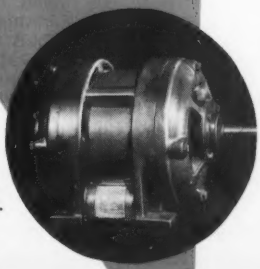
UNASSAILABLE!



The Allis-Chalmers Mfg. Co. builds standard motors of every type from 1 hp. up . . . also motors for special application.

• Allis-Chalmers Seal-Clad Motors are the sturdiest motors on the market—bar none. And in addition to their great strength, they can be depended upon, always, because they are unassailed by the weakening and destructive agents that affect other motors. Allis-Chalmers Seal-Clad Motors are unassailed . . . by metallic dust, grit, oil, moisture, chemicals, or by other destructive agents that are present, to some extent, in every plant.

The wound stator of an Allis-Chalmers Seal-Clad Motor receives an impregnating treatment similar to the conventional type of winding. But in addition, ultimate protection is assured by a Moulded Bakelite Shield, of high dielectric and mechanical strength, which is fitted into a machined slot in the stator frame and sealed into position with a special compound. Thus the coils are completely protected by hard, smooth shields that are impervious to the attacks of damaging agents.



ISN'T THIS UNASSAILABLE ASSURANCE WORTH WHILE . . . PERFECT PERFORMANCE UNDER ALL CONDITIONS, AT NO EXTRA COST?

For further details, write for Bulletin No. 2182

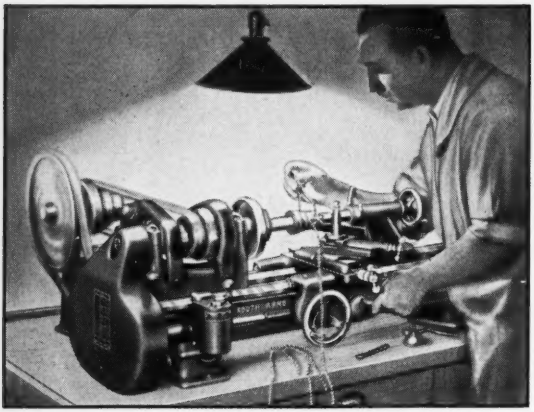
838

MOTOR DIVISION

ALLIS-CHALMERS

MILWAUKEE WISCONSIN

screw threads from 4 to 112 per inch, including 11½ in. pipe thread, and has power longitudinal feeds of 0.002 in. to 0.015 in. per revolution of the spindle. Another feature is the new 12-speed model with spindle speeds ranging from 40 to 1200 r.p.m., adapting the lathe to



South Bend 1938 Model 9-In. Workshop Lathe

machining very small diameter parts with precision-accuracy.

Other features of the 9-inch Workshop Lathe include a simplified twin gear reverse for cutting right and left-hand screw threads improved back-geared headstock with adjustable and larger spindle bearings and a ball thrust bearing on the ¾ in. hollow steel spindle, a heavier designed saddle with adjustable gibs on cross feed and compound rest, a precision lead screw guaranteed to meet the most exacting requirements for cutting accurate screw threads on master taps, precision thread gauges, and so on, and all gear teeth are precision cut from solid steel or semi-steel blank

The different types of the 9-inc Workshop Lathe are : (1) The new speed lathe; (2) The Adjustable Hor zontal Motor Driven Bench Lathe; (The Underneath Belt Motor Drive Bench Lathe; (4) The Pedestal A justable Motor Driven Flo Leg Lathe; (5) The Doub Friction Countershaft Drive Lathe; (6) The 9-11 in. Swin Raising Block Lathe, and (The Tool Room Lathe wit draw-in collet chuck, gradu ated taper attachment, threa d i a l indicator, micromet carriage stop, and chip pan.

The one-piece cast, sem steel lathe bed has prismat v-ways, handscraped to pr vide the finest bearing su face and assuring permanen alignment of the headstoc tailstock and carriage. Fo 3½-ft., 4-ft., with distanc bed l e n g t h s are available 3-ft., between centers of in., 23 in., 29 in. and 35 i respectively.

More than 35 attachmen may be fitted to the 9-inc Workshop Lathe to increa its range of operations.

Sunnen Ring Compressor

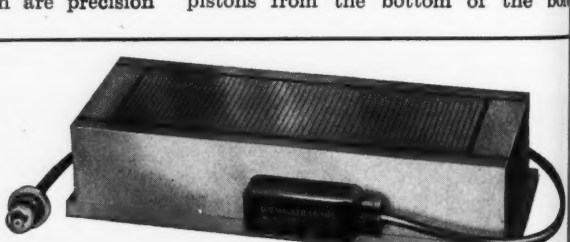
A ring compressor, especially designe to overcome many of the troubles pr viously encountered with tools of th type, has been announced by the Su nen Products Company, 7903 Manche ter St., St. Louis, Mo. Features of th compressor include a patented lip th prevents flaring out of the top ri when the band is ready to slip off t piston, and even distribution of tensi over the entire surface of the band.

In some cars it is necessary to insta pistons from the bottom of the bor

Set-up Time
Becomes
Production Time

Walker Magnetic Chucks save from 20% to 50% in chucking labor by eliminating slow-acting jigs and fixtures for metal removing operations on lathes, shapers, drills, presses, planers, grinders, etc. Write for catalog W 3.

O. S. WALKER CO., INC.
WORCESTER, MASS.



No. 617 Bar Pole Face Rectangular Magnetic Chuck
Available in sizes 6x10 to 12x60

The Most Vital Part of the Tap is HERE

So—Bath Taps are "HARDENED IN THE SOLID AND GROUND FROM THE SOLID"

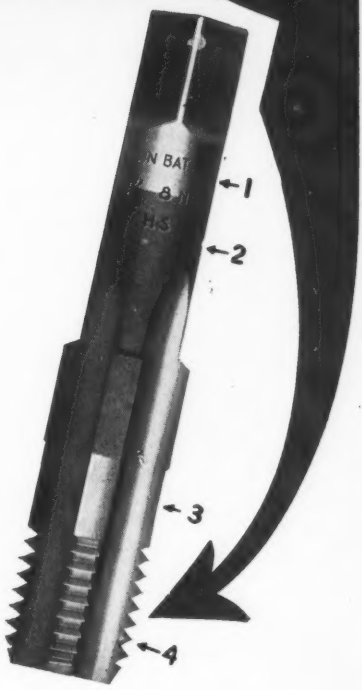
To produce the most nearly perfect grain structure in teeth so vital to long, accurate and profitable Tap performance—

The tap shown at the right is called our "Process Blank" showing the 4 Major steps Bath taps pass through.

1. **Shows the amount of material removed in grinding the shank.**
2. **Shows the unfinished hardened surface as it comes from the heat treatment. Note the absence of threads in the hardening operation—no over-heated brittle threads; no under-heated soft threads.**
3. **Grinding on the major diameter. Note that sufficient material has been removed from the tap blank so that all hardening decarbonization is removed from the tops of the teeth.**
4. **Threads which are GROUND FROM THE SOLID—AFTER HARDENING in ideally hardened steel.**

But Bath goes farther than this—and by highly-developed, patented grinding procedure gives each tap an unusually smooth finish. This not only adds to the appearance of the tap (the difference is glaringly noticeable under a magnifying glass), but considerably lengthens the tap life, and improves its accuracy.

The High Finish on Bath Taps also results in lower power consumption and reduced tap breakage.



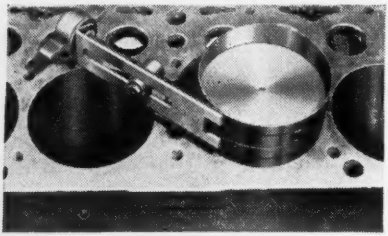
Our Field representative will gladly assist you with your tapping problems.

May we send one to your shop? No obligation, of course.

JOHN BATH & COMPANY, INC.

WORCESTER, MASS.

with the Sunnen Ring Compressor this operation is easily accomplished with the rings in place, due to the fact that the band can be slipped out around the



Sunnen Ring Compressor

crankshaft. According to the manufacturer, the extra labor formerly required to push the pistons up through the cylinder and install the rings above the top face of the block is eliminated by the use of the Sunnen Ring Compressor.

This compressor, which was developed because of the increased use of inner rings and greater ring pressures, is said to close all rings completely and keep them closed until the pistons are i place. With a complete range of thre bands, it will handle all piston size from 2.2 in. to 3⅞ inches.

Brown & Sharpe No. 206 Centrifugal Motorpump

Brown & Sharpe Mfg. Co., Providence R. I., has designed a Centrifugal Motor pump especially for supplying coolan for machine tools and light machinery for use where dirt or abrasive may b present in the liquid, and where a mod erate volume of flow is desired at a lo head. The pump is fitted with a full enclosed motor and grease sealed ba bearings which aid in protection agains grit and other foreign substances. Th stainless steel shaft is integral with th motor, providing simplicity and strength and the aluminum bronze impeller i the open or non-clogging type. The im peller is hydraulically balanced and i designed to allow abrasives to be dis charged without excessive wear within the housing. The discharge pipe clear the motor, which is a convenience i installation.

The Motorpump is designed to b mounted in a tank with the maximum

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CUTTERS
Standard styles and sizes for your ordinary jobs.
Special to your order for your out of the ordinary jobs.
Send for Catalog 134-A.
THE TOMKINS-JOHNSON COMPANY
JACKSON, MICHIGAN

BETTER SURFACE GRINDING

SURFACING of airplane motor cylinder blocks is typical of many operations where Bakelite Resinoid bonded abrasive wheels save time and expense. Stronger, heat-resistant, cool-running and non-gumming, these wheels permit higher speeds, require less dressing. Write for booklet 47G, "High Speed Abrasive Wheels," which explains why Bakelite Resinoid bonded wheels operate safely and efficiently up to 16,000 s. f. p. m.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.

BAKELITE
BONDED WHEELS

FOR ECONOMICAL HIGH SPEED GRINDING

FlexoiD
INDUSTRIAL COUPLINGS

No Back-lash
Never Become Noisy
Require No Lubrication
Operate Horizontally or Vertically
Absorb all vibration, Shocks and Jolts

Here's why you save with FLEXOID Couplings: They are impervious to action of oil, water, sand, grit—Can be used on reversing drives because there is no lost motion—Practically indestructible.

Write for leaflet

FlexoiD Coupling Co.

Division of

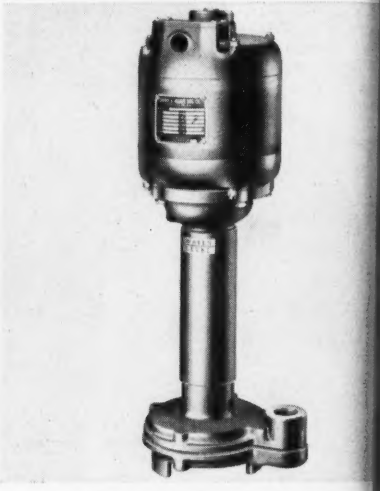
The Smith Power Transmission Co.

410 LAKESIDE AVE., N. W.

CLEVELAND • OHIO

depth of submersion indicated by t water line. The pump is powered handle liquids up to 500 S.S.U. T capacity lessens with increase in v cosity.

The pump can be supplied with a 1 volt, one phase, 60 cycle, 1725 r.p.m ¼ h.p. motor, or with either 220, 4



Brown & Sharpe No. 206 Centrifugal Motorpump

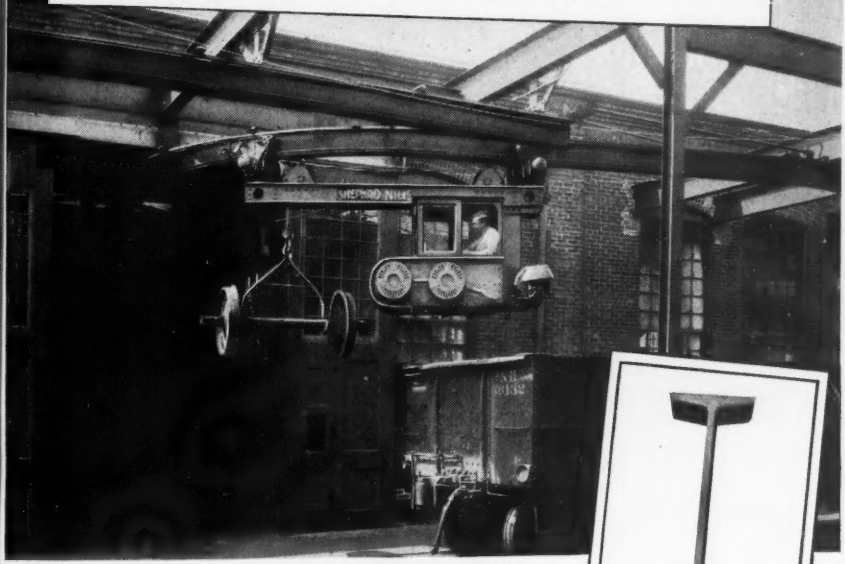
or 550 volt, two or three phase, 50/ cycle, 1425 or 1725 r.p.m., ¼ h.p. mot Net weight in all cases is 40 pounds.

Allen-Bradley Heavy-Duty Push Button Control Station

A new line of Bulletin 800 heavy-du control stations, of the surface and flu mounting types, has just been develop by the Allen-Bradley Company, 1313 First St., Milwaukee, Wis., to supplan their existing line of heavy-duty st tions. These units have a maximu d-c rating of 2.5 amperes, 115 volts; 1 amperes, 230 volts; 0.25 amperes, 5 volts. Maximum a-c rating: 10 amper 110-220-440-550 volts.

The push button mechanism is the unit type construction and can mounted in combination of one to t buttons. These units have a set of no mally open and a set of normally clos double break, silver alloy contacts. Tw way and three-way selector switches a pilot light utilize the same base and

Aerial Railway OF INDUSTRY



Several departments in two separate buildings are served by this Shepard Niles monorail hoist

Shepard Track consisting of two special analysis T-rails clamped to the bottom flange of a standard I-Beam insures a smooth, hard, long-wearing track for monorail hoists.

• One Shepard Niles electric monorail hoist gives "express service", indoors or out, to any point in the plant or yard carrying loads of every description. Furnished with single or double hooks in capacities from ⅛ to 10 tons.

They are also ideally suited to the accurate control of any standard electro-magnet or grab bucket.

Write for catalogs illustrating and describing the "Aerial Railway of Industry".

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

424 SCHUYLER AVENUE . . . MONTOUR FALLS, N. Y.

interchangeable with the push buttons.

Bulletin 800 surface mounting stations have an attractive modernistic, black enameled, pressed steel enclosing box, with multiple knockouts on top and bottom. Removing the front cover exposes both front and sides, permitting easy wiring and inspection.

Allen-Bradley Heavy-Duty Push Button Control Station

Flush mounting stations are available in combinations of one to five units. The frame is adjustable so that the standard stations can be used on panels up to 1¼ in. For panels up to 3 in., an extra long shank can be supplied on the button. Flush mounting push button stations can be arranged for wiring from the front or back. Because of their simple, rugged construction and attractive appearance, Bulletin 800 heavy-duty push button control stations are well suited for machine tool applications.

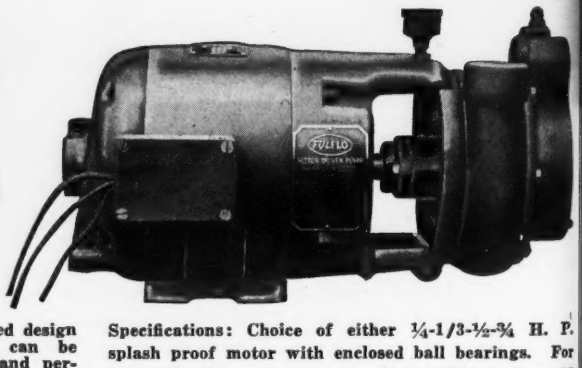
Themac Type J Grinder

The illustration shows the Themac Type J Grinder which has been brought out by The McGonegal Manufacturing Company, Jones Bldg., East Rutherford, N. J. This tool is powered with a 1/ h.p. 110-115 volt universal motor operating on 25 to 60 cycle A.C. or D.C. current. The spindle speed is 16000 r.p.m. idling and 6000 r.p.m. under full load. The motor is cooled by forced ventilation.

The grinding spindle is mounted on precision ball bearings. Distance from center of spindle to center of T-slot

TRADE MARK
FULFLO
REG. U.S. PAT. OFF.

CENTRIFUGAL COOLANT PUMPS



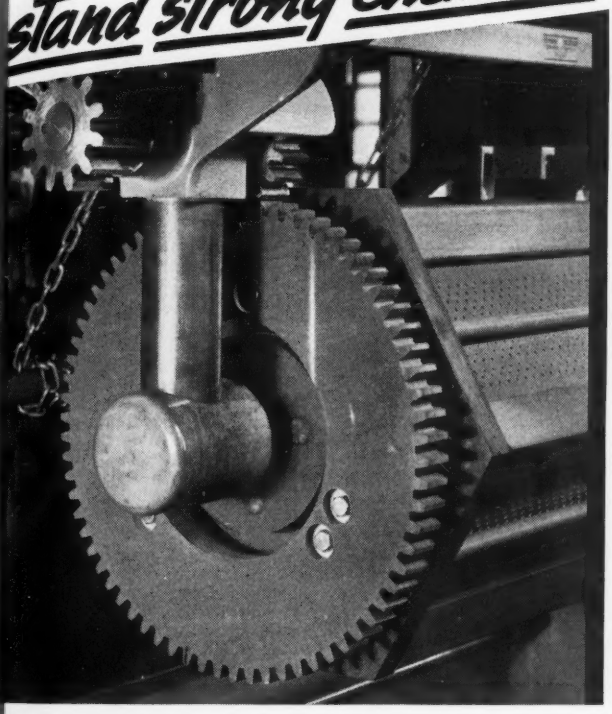
The Pumps of well balanced design and construction. They can be mounted in any position and perform to perfection.
Regardless of grit and chips centrifugal pumping action insures dependable flow of cooling solution at all times.

Specifications: Choice of either ¼-1/3-½-¾ H. P. splash proof motor with enclosed ball bearings. For standard voltage or current. Pumps deliver from 25 to 70 gal. per minute at 10 ft. head. Cast iron body with bronze impeller. Either straight or priming cover. Spring tension packing. No bearings in pump.

FOR FULL INFORMATION WRITE

FULFLO SPECIALTIES CO., INC.
BLANCHESTER, OHIO

FORMICA GEARS *stand strong chemicals*



FORMICA gears stand strong chemicals and so are widely used in plating equipment where the acid solutions are so strong that few materials will tolerate them. The picture shows a sixteen inch driven gear with a two inch face in some plating equipment built by the Crown Rheostat & Supply Company, Chicago.

Formica is also used in many parts in rayon mills where destructive solutions are common. Chemical inertness is one of the important characteristics of Formica gears and many machinery builders find it a help in building equipment that will last.

Let us send you the Formica gear book which contains tables on gear sizes for different jobs and much other useful information.

THE FORMICA INSULATION CO.
4640 Spring Grove Ave. Cincinnati, Ohio

FORMICA

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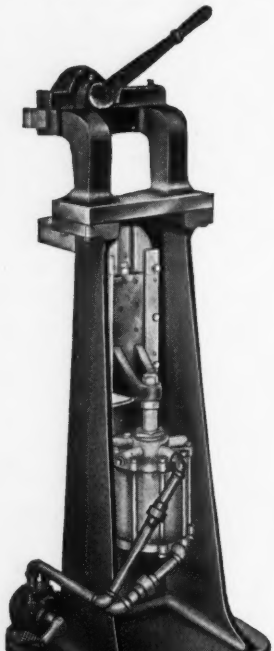
Gear Specialties, Inc.
Chicago, Ill.
Merkle-Korff Gear Co.
Chicago, Ill.
Chicago Gear Works
Chicago, Ill.
Foote Gear Works
Cicero, Ill.
The Cincinnati Gear Co.
Cincinnati, O.
Clarksville Foundry & Machine Co.
Clarksville, Tenn.
The Horsburgh & Scott Co.
Cleveland, O.
The Stahl Gear & Mch. Co.
Cleveland, O.
The Master Electric Co.
Dayton, O.
The Adams Company
Dubuque, Ia.
Hartford Special Mchy. Co.
Hartford, Conn.
Beaty Machine Works
Keokuk, Ia.
The Generating Gear Co.
Milwaukee, Wis.
Badger State Gear Co.
Milwaukee, Wis.
Precision Machine Co.
Milwaukee, Wis.
E. A. Pynch Co.
Minneapolis, Minn.
Joaquin Alemany Lopez
Havana, Cuba
New Jersey Gear & Mfg. Co.
Newark, N. J.
Prager, Inc.
New Orleans, La.
J. Morrison Gilmour
New York City
Sier-Bath, Inc.
New York City, N. Y.
Mid-State Elect. Engr. Co.
Osceola Mills, Pa.
Puritan Machine Co.
Omaha, Neb.
E. M. Smith Machine Co.
Peoria, Ill.
The Eagle Gear & Mch. Co.
Philadelphia, Pa.
Rodney Davis and Sons
Philadelphia, Pa.
The Pittsburgh Machine & Supply Co.
Pittsburgh, Pa.
Perkins Machine & Gear Co.
Springfield, Mass.
Winfield H. Smith, Inc.
Springville, N. Y.
Alling Lander Company
Sodus, N. Y.
Charles E. Crofoot Gear Corp., South Boston, Mass.
Arlington Machine Co.
St. Paul, Minn.
Farwell Mfg. Co.
Toledo, O.
Diefendorf Gear Corp.
Syracuse, N. Y.
Batson Cook Co.
West Point, Ga.
Worcester Gear Works
Worcester, Mass.
Massachusetts Gear & Tool Co., Woburn, Mass.

MARKING

FLAT—ROUND IRREGULAR SURFACES BY ROLLING OPERATION



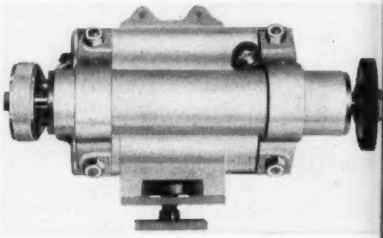
MODEL 25
HI-DUTY MARKING MACHINE

This machine operates from your plant air line, and is one of numerous models built to produce fast, neat marking on metal parts. Hi-Duty marking machines may be had for practically any marking operation, and we will be glad to make recommendations upon receipt of your inquiries. Send prints or samples of parts to be marked, showing lettering and location, also state required production.

GEO. T. SCHMIDT, Inc.
1806 BELLE PLAINE AVE.
CHICAGO, ILL.

bolt: minimum, 1 15/16 in.; maximum 2 23/32 in. Minimum distance fro mounting base of grinder to center spindle is 3/8 inch.

Equipment includes two pulleys, No 2 and 3, one belt, cord with feed-throug switch and attachment plug, two 5/8-i

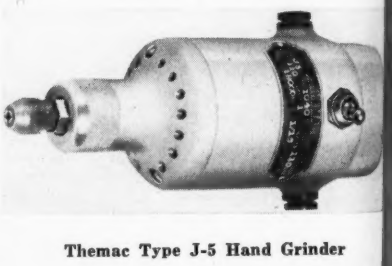


Themac Type J Grinder

and two 1-in. wheel collars, extensio spindle with screw and collar, can of o one wrench, a No. 2 clamp nut, whee 2x3/8x3/8 and 1x1/4x1/4 in., and recesse wheels 3/4x1/4x1/8 and 1/2x1/4x1/8 in. Weigh of machine complete, 8½ pounds.

Themac Type J-5 Hand Grinder

The McGonegal Manufacturing Com pany, East Rutherford, N. J., is no marketing a hand grinding tool to b known as the Themac Type J-5 Han Grinder. This grinder illustrated her with is 1/15 h.p., 18,000 r.p.m., the mot being universal A.C. or D.C. The to



Themac Type J-5 Hand Grinder

is especially intended for finishing op erations on dies and similar work. Ina much as it weighs but 2 lbs., it is easi manipulated for the fine grinding r quired in smoothing and correcting in accuracies in forging and stamping die

The tool can be supplied with eith a No. 0 Jacobs Chuck of 1/8-in. capacit No. 1341 Themac Chuck of 1/8-in. C pacity, or No. 1342 Themac Chuck

The Tool Job Starts Right

- and Stays Right

when it's a

MILNE TOOL STEEL

identified by the

NEW COLOR BAR CODE

The different grades of Milne Tool Steel are now identified by bright lacquer colors *sprayed the entire length of the bar.*

Stock clerk, tool maker, heat-treater, — anyone handling these steels can tell the grade at a glance, no matter how small the piece being worked.

Eliminate confusion and costly errors in your toolroom by using Milne Tool Steels and the Color Bar Code.

A Wall Chart of the Color Bar Code, in exact colors, and including heat treating instructions, will be sent to tool steel users on request. Ask a Milne representative, or write our nearest office.

Get your copy of the NEW *folder describing the* **COLOR BAR CODE**

It also includes the handy

TOOL STEEL SELECTOR TABLE

. . a helpful guide in the choice of the right steel for the job. Ask a Milne representative or write to our nearest office.

NEW YORK 741-3-5 Washington St.

A. MILNE & CO.

BOSTON 915 Oliver Bldg.

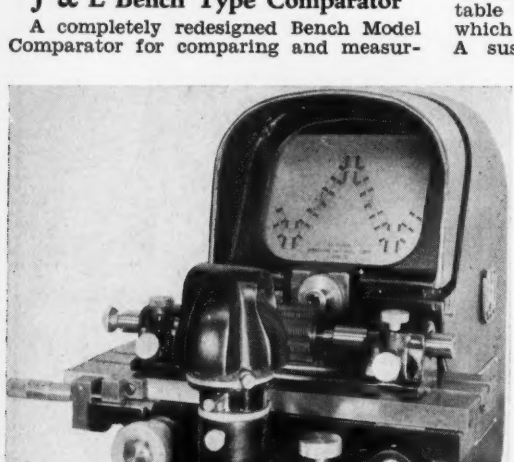
CHICAGO PITTSBURGH NEW ORLEANS DETROIT

HIGH SPEED STEELS • ALLOY TOOL STEELS • CARBON TOOL STEELS

3/32-in. capacity. Equipment includes two wrenches, three pencil wheels, can of oil and 10 ft. of rubber-covered cord with attachment cord.

J & L Bench Type Comparator

A completely redesigned Bench Model Comparator for comparing and measuring by optical projection, available in two styles, has been announced by the Jones & Lamson Machine Company, Springfield, Vermont.



J & L Bench Type Comparator with Movable Table

In one style the machine is supplied with a plain table suitable for holding staging fixtures to position objects before the projection lens for comparing the magnified shadow against a master outline on the screen.

The other style of machine is provided with a movable table, 16 in. long for measuring lead or spacing. This table is supported and guided on ball which permit rapid and easy traverse. A suspended weight holds the table anvil against the micrometer anvil attached to the bed. This affords uniform pressure between these measuring points to insure duplication of readings. Lead measurements up to 2 in. at one setting may be accomplished by the use of micrometer, end measuring bars or spacing blocks. The standard micrometer is graduated in 0.0005 in. A micrometer graduated in 0.0001 in. can be supplied if desired.

Standard centers and center blocks will stage objects 3 in. in diameter by 11 in. long; for instance, tops, hobs and circular form cutters. V-block stages and vise fixtures are standard equipment for staging objects which can not be held between centers; for instance, flat form tools, gages, product, and so on.

Focusing of the object on the new machine is accomplished by moving the work-carrying table to and from the projection system. Lenses may be supplied to give the following magnifications: 90X, 50X, 31¼X, 16X and 10X.

Vibrometer

An instrument for measuring the amplitude of vibration of structural or machine members, to be known as the Vibrometer, has been announced by the

KELLY
CRANK SHAPERS
HEAVY DUTY
Made exclusively in the HEAVY DUTY TYPE, KELLY Shapers are guaranteed by the manufacturer for satisfactory performance, accuracy, material and construction. Sizes 16" to 36" stroke.
Write for catalog.
GENERAL ENGINEERING & MFG. CO.
ST. LOUIS MISSOURI
SINCE 1895

WILLIAMS

SUPERIOR DROP-FORGED TOOLS

"SUPERIOR"

(IMPROVED CARBON STEEL)

WRENCHES

These improved wrenches offer a sensational value. They are approximately twice as strong as old-fashioned wrenches of this type ... average 93% as strong as alloy steel wrenches of similar size.

In the Double Head Engineers' Pattern (illustrated) "Superior" Wrenches are actually stronger than thin alloy wrenches in this popular pattern. They cost considerably less! Available in 50 patterns, over 1000 sizes. Ask your distributor for Williams' "Superior" Wrenches.

Write for free booklet "How to Select and Use Wrenches."

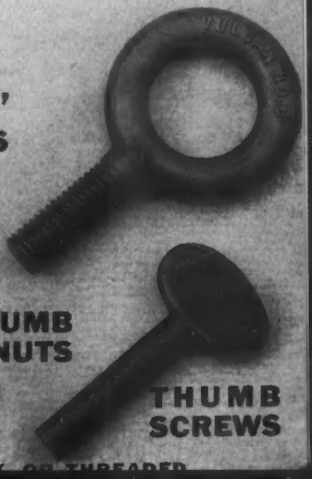
You can always depend on Williams' drop-forgings. . . . Williams' "Vulcan" brand is the symbol of top quality in Eye Bolts, Thumb Nuts, Thumb Screws, Hoist Hooks, Rope Sockets, etc.

J. H. WILLIAMS & CO.

260 Spring St., New York

Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable Socket Wrenches, Reversible Ratchet Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc.

1-490



ALLOY STEELS

Free machining qualities, uniform analysis, excellent physical properties . . . . these qualities make HY-TEN and ECONOMO Steels a more economical . . . . more efficient material for your special steel parts.

STANDARD S.A.E. STEELS IN STOCK

Write for free copy of Steel User's Data Sheets, containing valuable information on the use and treatment of special steels.

Wheelock, Lovejoy & Co., Inc.
130 SIDNEY ST., CAMBRIDGE, MASS.
CLEVELAND CHICAGO NEWARK
DETROIT BUFFALO

American Instrument Company, 8017 Georgia Ave., Silver Spring, Md. The range of the instrument is from 0.00 to 0.030 in. amplitude.

The operation of the Vibrometer is simple. The instrument is held in the hand and the needle point is held against the vibrating part whose amplitude is to be measured. The vibrating motion of the spindle is transmitted directly to the Vibrometer point, which appears as bright yellow against a black background. The vibrating pointer appears double to the eye of the observer and the apparent intersection of the two images, read on the scale in the back-

Vibrometer

ground, gives the amplitude of vibration directly in thousands of an inch.

The weight of the Vibrometer is 2 lbs. this heavy type of construction being used to avoid inertia effects during use. The design is such that no damage can result to the instrument when it is applied to a vibrating member the amplitude of which is greater than 0.030 inch.

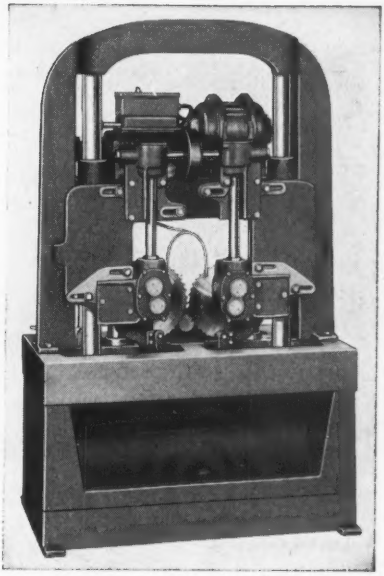
Rockwood Fibre Lagging for Increasing Pulley and Flywheel Diameters

The diameters of driven pulleys can now be increased by the use of fibre lagging which is now being marketed for this purpose by the Rockwood Manufacturing Company, 1801 English Ave., Indianapolis, Ind. Increasing the diameter of the driven pulley permits increasing the size of the motor pulley and results in higher belt speed. With larger pulleys it is not necessary to have the drive belt so tight; thus the belt life is increased and cost of belt maintenance reduced.

It is often desirable to increase the capacity of a stamping press or other similar driven machine, upon which

A New Step Forward in HIGH SPEED PRODUCTION SAWING

WELLS
DUPLEX ROTARY
Cut-Off Saw

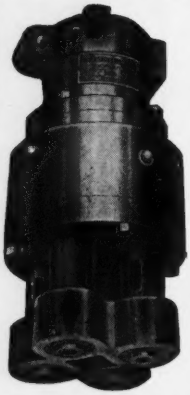


HERE'S a saw that's designed to cut your present sawing cost 50%. Entirely new in design and principle, it has proved, under extensive research and test, the answer to high speed work. Twin high-speed circular saws mounted on a carriage which slides on vertical posts, bite into the material on each side. This principle guarantees a three fold savings. (1) Permits two cutting edges working in the material at the same time, instead of the conventional one, and the cutting time is in direct proportion. (2) Enables use of much thinner saws which reduces material waste cost to a minimum. (3) Allows use of much smaller blades—materially reducing replacement costs. These production and cost saving features combined with a controlled hydraulic feed which guarantees accurate cut off to any length and to suit any material requirements is your answer to perfect High Speed Production Sawing—The material savings cost alone, pays for the equipment cost in a short time. Write for complete information.

• *Saw it the WELLS way* •

WELLS MFG. CORP. Three Rivers, Michigan

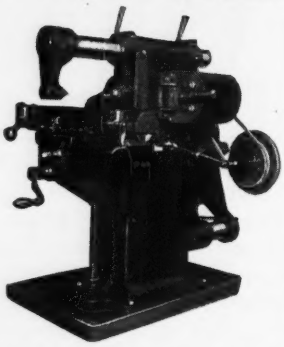
U.S. SPECIAL DRILL HEADS



U. S. Drill Heads are made in standard and special sizes. If your job requires special drill heads, our years of specialization in this work will save you money and assure an accurate, dependable and swift job. Send your blue prints for estimates.

The United States Drill Head Co.
1354 Riverside Drive
CINCINNATI, OHIO

BURKE Milling Machines



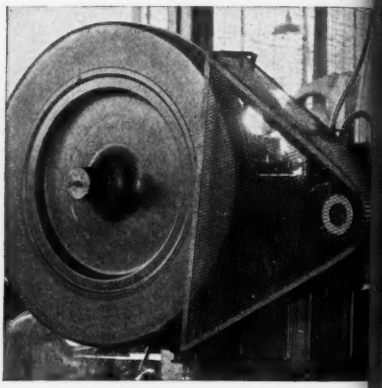
Burke motor driven milling machines, Nos. 1, 2, 3 and 4 are specially suited for handling small, difficult work on a production basis.

Write for complete information.

BURKE MACHINE TOOL CO.
297 E. 16th St. Conneaut, Ohio

is found that the flywheels are t small and thus to increase spe smaller motor pulleys than the m manufacturer recommends may be u Increasing the speed in this man fosters bearing troubles and reduces life. The use of larger pulleys ma it possible to eliminate these difficult

The size of a flywheel or pulley can increased by the application of a Ro wood Fibre Lagging, which is made the same material as Rockwood Pa Pulleys. The compressed end grain fi belt surface provides an ideal pull surface. The lagging is supplied in a width desired and up to 72 in. in dia eter. It is applied by clamping to t



Punch Press Flywheel Equipped with Ro wood Fibre Lagging to Increase Diameter Capacity of Press

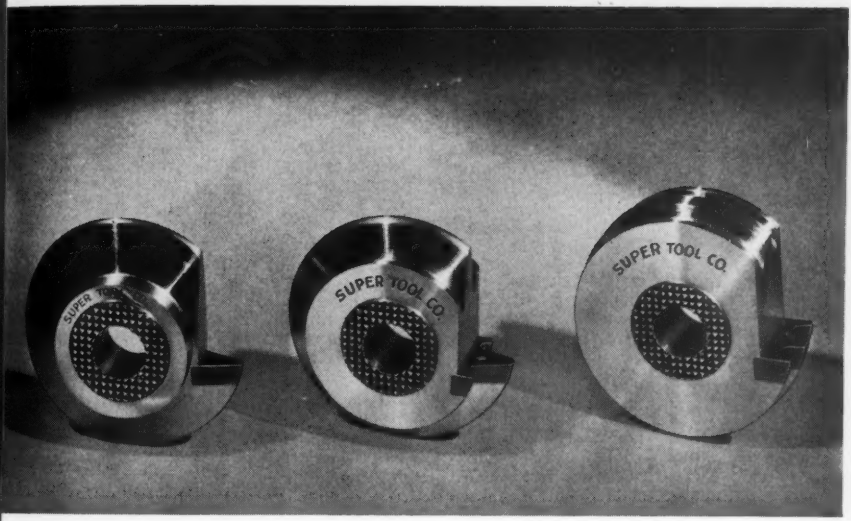
wheel rim by the use of a special cla of simple design.

The lagging is also used in place pulley covering where more transmitti capacity is needed, provided the 3 to in. increased diameter of pulley is n objectionable. Rockwood Lagging is s to retain its belt gripping capacity definitely and will not require repla ment. It is simple to apply and m save the expense of a new flywheel.

Black & Decker ¼-In. Low-Spee Ball-Bearing Electric Drill

An electric drill especially adapted stainless steel, Monel and other v hard metals has been placed on t market by The Black & Decker Mfg. C 720 Pennsylvania Ave., Towson, Md. T ¼-In. Low-Speed Drill has a stand spindle of 450 r.p.m. A powerful u

"SUPER" Circular Forming Tools with Cemented Tungsten Carbide Tips



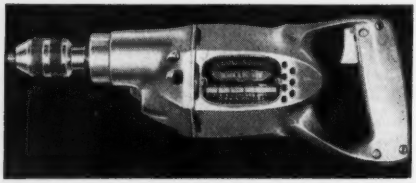
These Circular Forming Tools with Cemented Tungsten Carbide Tips are producing more work—and better work—at a lower cost per piece.

Let us figure on your requirements of Standard or Special Carbide Tipped Tools, or advise you regarding possible new applications.

Write for our catalog and price list.

SUPER TOOL COMPANY
356 E. Congress St. Detroit, Michigan

versal motor, operating through a triple-reduction gear train, provides ample torque for tough steel drilling applications. The armature and spindle are mounted on ball bearings. To facilitate



Black & Decker ¼-In. Low-Speed Ball-Bearing Electric Drill

the quick changing of drill bits, the unit is equipped with a "Portomatic" keyless chuck and patented gear locking pin.

The capacity of the drill is ¼ in. in steel and ½ in. in hardwood. Standard speed is: no-load, 450 r.p.m.; full-load, 385 r.p.m. The overall length is 13 in. and the net weight is 6¼ pounds.

Standard equipment includes a three-conductor cable and plug, "Portomatic" keyless chuck and gear locking pin, instant release trigger switch with locking pin, and a universal motor for eith A.C. or D.C. operation. The drill regularly supplied for 110 volts, but also available for 32, 220 or 250 volts.

Boice-Crane Oscillating Spindle Sander

The Boice-Crane Company, 1726 No wood Ave., Toledo, Ohio, is offering Oscillating Spindle Sander and Grind for wood and metal finishing.

This machine tool is recommended pattern makers for sanding cores an any irregular edge work on either woo or metal patterns, also to cabinet make and school shops and to industry havin curved inside or outside edge grindin or finishing on metal parts. It is espe cially valuable in the metal working in dustries for grinding off feather edge on alloy castings, for smoothing up i regularly shaped alloy and aluminu castings.

The oscillating spindle carries rubbe drums of various diameters to whic endless tube-like abrasive sleeves ar mounted by merely expanding the rub ber drums. The manufacturer carries large assortment of these drums an sleeves from 1 to 3-in. diameter. Max

NEW

U. S. No. 1 Anti-Friction Bearing

Hand Milling Machine

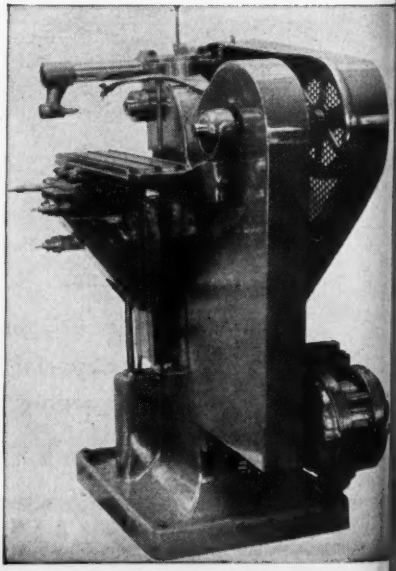
The New U. S. Hand Miller is particularly adapted to high speed light milling operations. Vertical and horizontal feeds.

Improvements: Heat treated chrome nickel steel spindle, Timken bearings, Ballbearing countershaft, V-belt drives, 6 Spindle Speeds up to 1592 R.P.M., providing efficient use of small end mills.

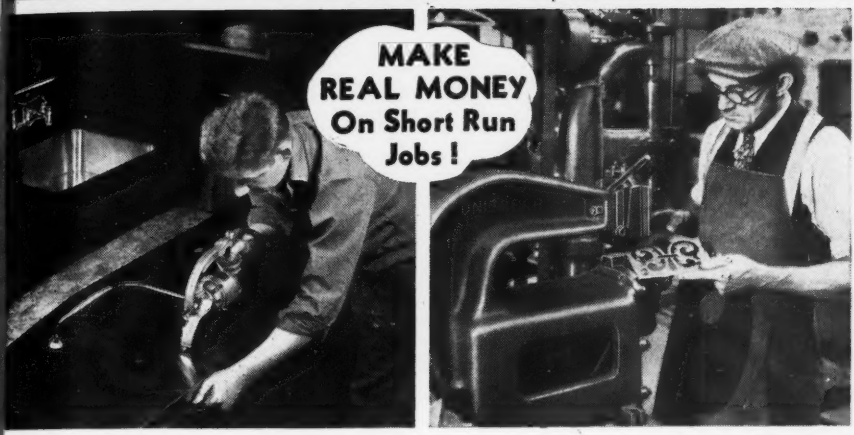
Write for full details.

The UNITED STATES MACHINE TOOL Co.

1954 W. 6th St. Cincinnati, Ohio



YOU CAN *EXPECT MORE* FROM A STANLEY ELECTRIC TOOL

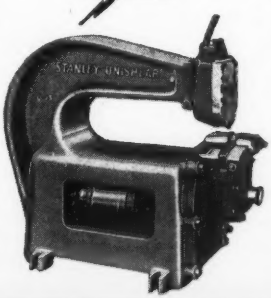


"Short run jobs" — orders that cause most of your grief—can be handled easily and profitably with Stanley Unishears. Heavy cost of trimming dies, setting up complicated power-consuming machines is eliminated. Just plug a Unishear in and go to work, cutting any sheet material any pattern. Learn more about these exclusive Stanley Electric Tools! Ask your distributor for demonstration on *your* work, or write for information. Stanley Electric Tool Division, The Stanley Works, 137 Elm St., New Britain, Connecticut.

"MIGHTY MIDGET"
— Only $61.00

Portable — weighs only 7 lbs., yet cuts up to 18 gauge hot rolled steel, as fast as you feed; other materials in proportion. Plugs in any light socket, makes smooth, accurate cuts, any pattern, at 2400 strokes per minute. Two other portable models.

STANLEY



MODEL 0-15
Stationary Unishear

15″ throat, cuts up to 14 gauge hot rolled steel, other materials in proportion. Starts inside a sheet without starting holes, cuts curves down to ¼″ radius. Six other stationary models cut up to ¼″ boiler plate.

STANLEY UNISHEARS
THE ELECTRICALLY-DRIVEN HAND SHEARS

mum clearance of drums above the tilting table is 6 inches.

A new design of gear drive was chosen

Boice-Crane Oscillating Spindle Sander

for long wearing qualities and quiet operation. Belted motor drive from a 1750 r.p.m. motor develops a spindle speed of 2500 r.p.m. and 83 oscillations per minute. A unique feature claimed by the manufacturer is the ball bearing oscillating action requiring only occasional lubrication, and splash feed oiling to all other moving parts.

A two-way tilting work table measuring 20 in. square is tilted mechanically with crank and worn mechanism, with all angles indicated by an easy reading dial and pointer.

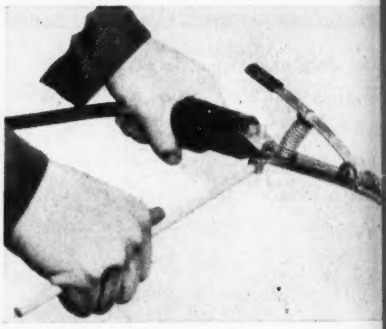
Lincoln Type ST Electrode Holder

An arc welding electrode holder, the feature of which is remarkably light weight for the capacity, has been a nounced by The Lincoln Electric Co pany, Cleveland, Ohio.

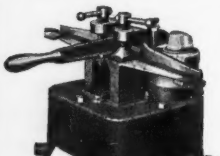
The new holder, designated "T ST", weighs only 14 ounces and has current capacity of 250 amperes contin ous, equaling that of many type hold weighing 25 ounces or over. The li weight, obtained without any sacrifi of capacity, is attributed to use formed steel parts, electrically welde

Unique for its light weight, the hold has a number of other advanced fe tures, most important of which is pro ably the extremely simple type of co nection which assures positive conta and eliminates loose connections, a mo or less common cause of overheati in holders.

To assure permanence of connection all contacts are electrically welded. Co nection to cable is provided by a speci easily operated clamp which locks t cable to the electrode holder. The clam can be tightened or loosened witho tools, by inserting a welding electro



Reduced operating fatigue is assured by r markably light weight and other features the Lincoln "Type ST" arc welding electro holder.



No. 162
Electric Brazer

For Fitting Narrow Band Saws

Accurately—Economically—Safely

In addition to the new filing and setting service, electric brazing by the latest method is now definitely proving a pronounced superiority over the older practices. Fast, economical, safe, easier to get perfect brazes.

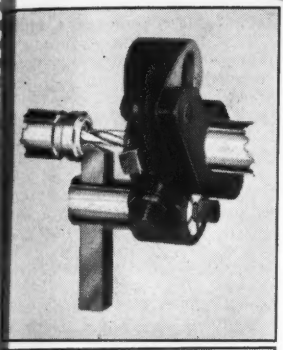
Perfected by the pioneers in the industry.

COVEL-HANCHETT CO.

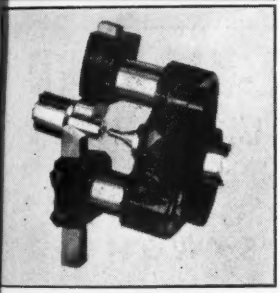
BIG RAPIDS MICHIGAN, U. S. A.

R 2 or 3 operations at one time L

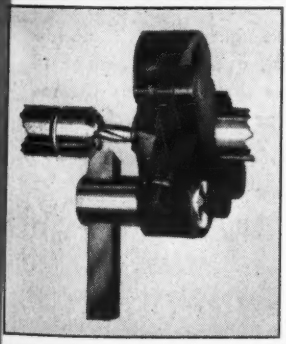
RIGHT LEFT



Turning and forming special shape while drilling or reaming.



Turning and centering.



Drilling and chamfering.

For you, this means increased production, lower costs and greater profits.

The illustrations at the left show a few of the many multiple operations of the R & L Tool.

You also save money on the initial cost. An assortment of right and left hand tools costs you $300.00. 1 R & L Tool, doing the same amount of work, costs $65.00. You save $235.00!

Let us show you how to save $235.00 and increase production at the same time. Write today for further information.

R&L TOOLS

1825 BRISTOL ST.
NICETOWN
PHILADELPHIA PA.

through a hole in the square head of the clamp cap screw and applying leverage. (Patent applied for.) When tightened, this clamp maintains positive contact with the flat-braided flexible copper strip which carries current to the jaws. The result is a complete copper low-resistant circuit direct from the welding machine through the holder to the electrode.

Other important features of the holder, in addition to light weight and easy connectibility, are: reduced overall width, permitting easier welding in corners and other confined places; rounded rather than square corners at important points to lessen the likelihood of contacting the holder and causing arcing; use of heavier copper jaws to assure maximum conductivity and prevent sticking of the electrode to the holder; grooving of the jaws for vertical and overhead as well as flat welding; a hollow fibre handle, correctly proportioned to fit the user's hand and afford a positive grip; fully insulated thumb lever and non-groundable sturdy spring.

The "Type ST" holder will accommodate any size electrode up to and including ¼-inch.

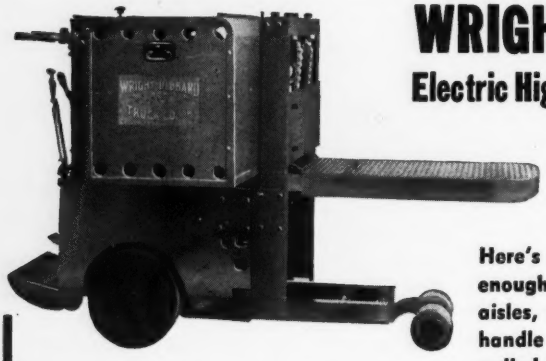
The light weight of the holder will be reflected in reduced operating fatigue, particularly in overhead and vert welding. The difference in working w the 14-ounce holder and the usual t weighing approximately 1½ pounds be readily appreciated by every welding operator.

Stark Electroblast Hydrogen Brazing Furnace

The Stark Electroblast Hydrogen Br ing Furnace now being built by St Tool Company, Waltham, Mass., was d veloped from the Stark Electrobl High Speed Muffle Furnace also bu by this firm. The new furnace, howe is especially intended for the inexp sive, clean brazing of carbide-tipp tools.

The hydrogen brazing furnace is d signed for bench mounting, requir 15x20 in. of space. It consists of a he sheet steel case with cast iron ends a door, is lined with high grade insulati refractory which is easily replaceab and is furnished with a silicon carb muffle which excludes combustion ga and oxygen, and may also easily be r moved.

Heat is generated by a self-contain burner powered by a 1/15 h.p. Gene Electric ball bearing universal mot



WRIGHT-HIBBARD

Electric High-Lift Platform Truck

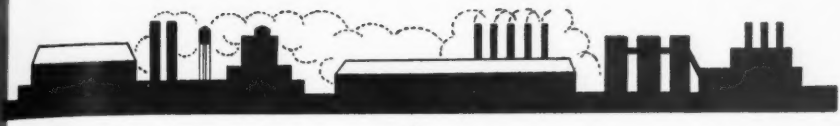
SMALL COMPACT STRONG

Here's a new high-lift truck, small enough to get through narrow aisles, etc., and strong enough to handle the same loads as the so-called large capacity trucks.

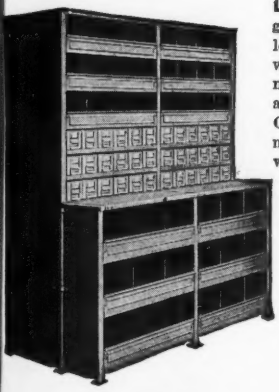
Maximum lift—72". Loading platforms—18" to 28" wide and 34" to 53" long.

Write for catalog No. 5 for further details on the high-lift truck. Information on other trucks on request. Write today.

WRIGHT-HIBBARD INDUSTRIAL ELECTRIC TRUCK CO. PHELPS • NEW YORK

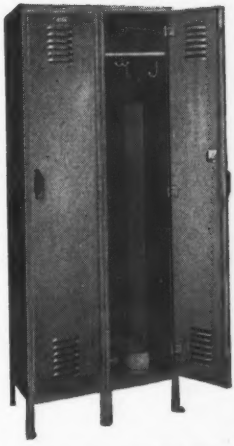


Investigate THESE TIME AND SPACE SAVERS

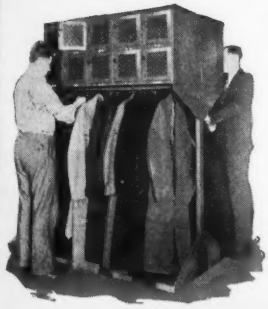


Lyon Steel Shelving gives greatest strength with the least amount of bulk or weight. Insures fast, economical parts handling and conserves floor space. Complete flexibility permits innumerable layout variations.

Shop Bench (with accessories). Top is one solid sheet of 10 or 12-gauge steel, punched for vice block or bench drawer. Available in 5', 6', 7', 8', 9' and 10' lengths.



Lyon Steel Lockers hold a high position in the regard of American Industry. Many exclusive features contribute to durability, ease of operation and space conservation. There are over 8,000,000 in use.



Shoprobe. Safe, complete locker facilities for 20 men in 12½ square feet of floor space. Separate compartments for each man. Coat-Lock-Chain runs through sleeve of coat to compartment lock. Heavy, rigid construction. Low initial cost.

LYON
STORAGE EQUIPMENT *Service*
LYON METAL PRODUCTS, INCORPORATED, Aurora, Ill.

LYON METAL PRODUCTS, INCORPORATED,
1301 River Street, Aurora, Illinois.

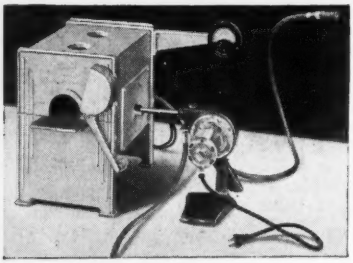
Please send information as checked: Bulletin on ( ) Steel Shelving; ( ) Lockers; ( ) Shoprobe; ( ) Shop Bench; ( ) Tool Cribs.

Name .....

Address .....

City ..... State .....

which supplies the high velocity air blast for combustion. The burner is separate from the furnace and may be used alone for brazing, soldering, or

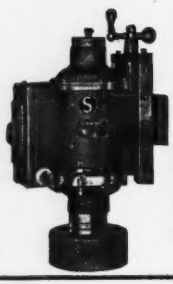


Stark Electroblast Hydrogen Brazing Furnace

other purposes for which an intense, easily directed heat is needed.

The furnace operates for seven cents per hour or less on artificial, natural or tank gas and makes it possible to quickly braze carbide-tipped tools without scale or excess copper or silver solder, thus saving time in grinding and finishing. The temperature is always under control which prevents destructive and weakening over-heating, well as under-heating which results a poor joint. In addition to its use a hydrogen atmosphere for brazing, unit is well adapted for the heat tr ment of high speed and carbon st at temperatures ranging from 1300 2400 deg. F. The hydrogen atmosph is provided by tank hydrogen which generally available at low cost. T furnace is provided with pressure re lator with two gauges and suita armored tubings for connection to tank and for fuel gas supply, and attachment which allows the hydrog to be led into the muffle through t thermo-couple opening at the rear the furnace.

Standard equipment includes a pyro eter with range of 0-2400 deg., pla num-rhodium thermocouple with c amic protection tube mounted in bracket conveniently located on t right side of the furnace, drop forg tongs and handled steel rod, hydrog pressure regulator with two gauges, su plies of copper foil, flux, and a bot of carbon tetrachloride.



STANDARD
VERTICAL ANGLE PLATE GRINDER
For Planer, Boring Mill, etc., 2 H. P. to 10 H. P. sizes.
Tool Post and Angle Plate Grinders for Lathes, etc.
Write for complete catalog showing Electric Drills, Heavy Duty Grinders, Disc Grinders, Buffing and Polishing Lathes.
THE STANDARD ELECTRICAL TOOL CO.
8th & Evans Sts.
Cincinnati, Ohio

Giant Grip "Industrial Model" Portable A. C. Welder

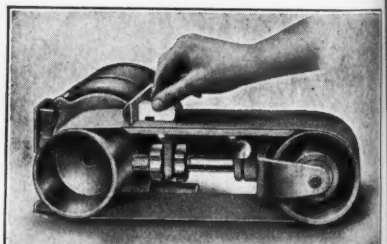
Designed exclusively for heavy servi in the average industrial plant, Gia Grip Mfg. Co., Oshkosh, Wisconsin, a nounces a new portable A. C. Weld Illustrated here, it is known as "Indu trial" model and has a current ran from 10 amperes to maximum outpu with open circuit arc in three voltag 80, 85, and 90, but higher voltage c be supplied if desired. The volta changes are easily accomplished b changing the leads in the box mount on the side of the cabinet.

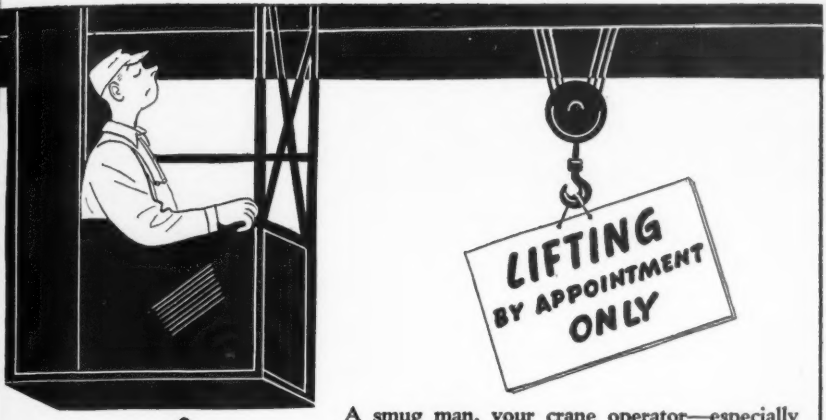
The transformer coils are so co structed to permit maximum cooli with elimination of "hot spots" in th

MORE WORK---LOWER COST

Here's a Belt Surfacer and Polisher that will give you more work at lower cost. For cleaning and finishing castings, removing burrs, straightening and finishing dies, etc. Ready to use—plug in any light socket—direct motor driven—no connections or attachments—no tools needed. Write for Bulletin 601.

Production Machine Co.
Greenfield, Mass.



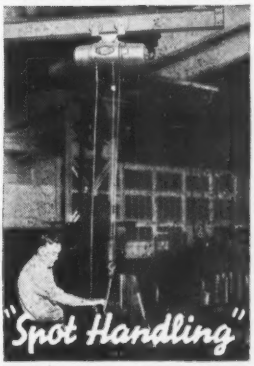


How the

ZIP-LIFT OPENS THIS BOTTLENECK

A smug man, your crane operator—especially if he's depended upon to keep your machine tools busy. He has a lot of other things to do—no wonder your machinists have to "make a date" with him and then wait. Men and machines dillydally—while lost minutes add up to lost hours, and lost hours to lost dollars.

Install this handy hoist over your machine tools—see how it eliminates delays, how easily and quickly it spots loads up to 750 pounds—safely and accurately to a fraction of an inch. By serving two or even three machines the low-cost, easily installed Zip-Lift stops the lag in production. Want details? Use Handy Coupon below. You'll see why it pays to forget chain blocks or overhead cranes as machine tool accessories.



The Zip-Lift stops waste with "Spot Handling"

HARNISCHFEGER CORPORATION

HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

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Harnischfeger Corporation, 4535 W. National Ave., Milwaukee, Wis.
Please send me a copy of Bulletin H-2:

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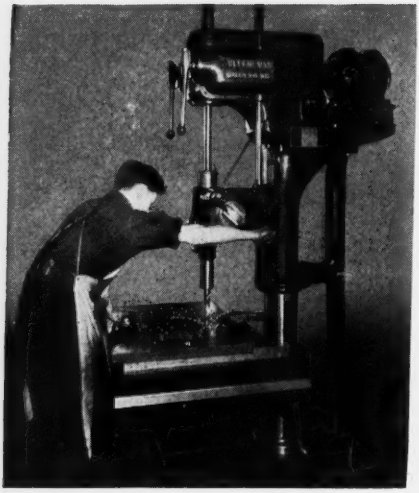
CLEEREMAN DRILLING MACHINES



SLIDING HEAD--

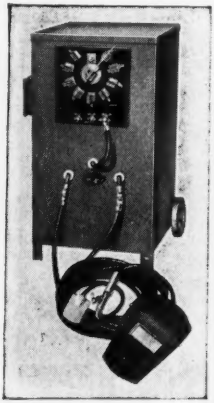
Round or Square Column

At work in the plant of the Brust Tool Manufacturing Company, Chicago, well known makers of precision tools and fixtures, this round column 25" Cleereman Drill is giving highly satisfactory performance . . . It is fully geared . . . has anti-friction bearings . . . is automatically oiled . . . has single lever control of feeds and speeds . . . can be furnished with square column and in special arrangements . . . Write for descriptive bulletin.

Cleereman Machine Tool Co.

Green Bay, Wis.

center of the coils, and has forced circulation to provide ample circulat of air. The knife switch control placed on the front of the cabinet. T welder has reactance control and st high frequency current and other f tures of construction as assurance t it will not overheat nor burn out un



Giant Grip Industrial Model Portable A. C. Welder

continuous service. It is made in fo models, from 330 to 600 amperage, a weight from 425 to 850 pounds.

Thorite Mallet

The Forsberg Manufacturing Compan Bridgeport, Conn., is now marketing mallet for use in aligning work in

Thorite Mallet

lathe chuck, for setting up work o machine tools, and for use in othe places where a mallet must be used b where the work cannot be damaged.

Mattison No. 464 Continuous Strip Grinder

The Mattison No. 464 Continuou Strip Grinder is designed for grindin strip coil through the use of factor coated abrasive belts. For example after hot rolled coils are pickled, an nealed and cold reduced, strips th

A

obs

HOLDS !

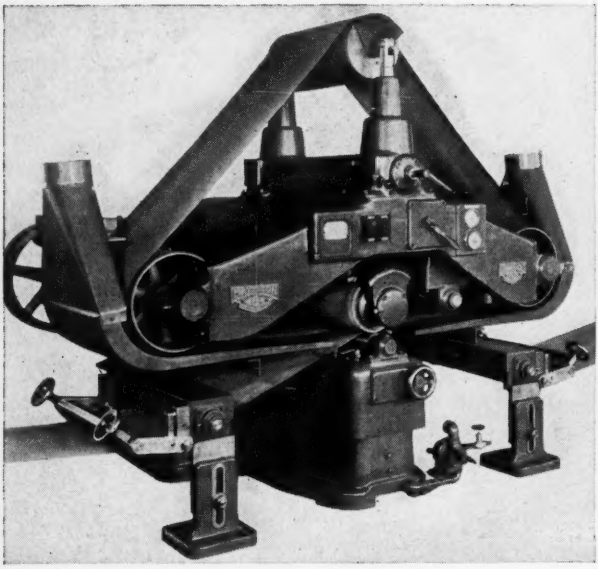
IPER

Corning Glass Works made Edison's first light bulb—and have now made this world's largest bulb, 14 feet high, to surmount the Edison Memorial Tower, Menlo Park, N. J. Weight 6000 pounds. 5200 Watts.

The Jacobs Ball Bearing Super Chuck is the greatest chuck in Jacobs history. It is everything that a chuck should be; everything that the most exacting user could demand.

E JACOBS MANUFACTURING COMPANY

TFORD CONNECTICUT, U. S. A



Mattison No. 464 Continuous Strip Grinder

show any imperfections are ground on this machine. Also after each additional cold reducing operation, coils that will not pass inspection are ground before annealing and pickling.

Power driven reels are placed at each end of the machine from which the strip passes guiding rolls, and over the work support roll. Work support roll is air actuated with quick movement for disengaging the work from the belt. Ample movement is provided to allow extra room for passing the strip under the belt in loading. Grinding roll is cushioned and has adjustable grinding tension.

Belt is driven fro both ends, so it ca be run in either di rection, according t direction the strip traveling. The flexin of the strip as passes over the sup port roll and th point contact of th grinding roll provide for fast-cutting bel action, and duplicate the action of th wide belt grinders o wide sheets. Made i widths for grindin 12 in., 18 in., 24 in and 36 in. wide strips

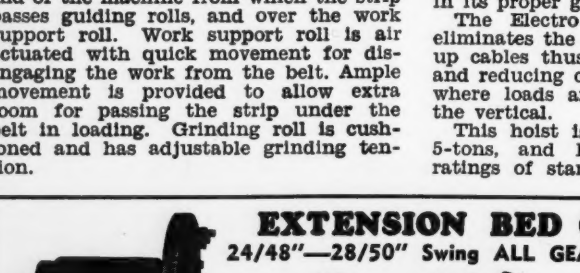
Electro Lift Rope Guide Hoist

The Rope Guide Hoist, built by Electro Lift, Inc., 30 Church St., New York City, and illustrated herewith, has been designed especially for side and end pulling or wherever the loads cannot be brought directly under the hoist.

This hoist has a drum with deep grooving allowing the cable to be completely submerged within the grooves. It is fitted with a traveling guide having a finger which runs in the groove ahead of the cable and which holds the cable in its proper groove.

The Electro Lift Rope Guide Hoist eliminates the hazard of crossed or piled up cables thus increasing the cable life and reducing cable breakage particularly where loads are pulled at an angle to the vertical.

This hoist is built in sizes of ¼ to 5-tons, and has all the speeds and ratings of standard Electro Lift Hoists.



EXTENSION BED GAP LATHE

24/48"—28/50" Swing ALL GEARED OR CONE HEAD

A lathe for small and large swing work. Long distance between centers. Three lathes in one. Saves space. Reduces cost.

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THE RAHN LARMON COMPANY **Cincinnati, Ohio**

ndred Horsepower Hands!

• Only one pair of hands; but placed on the hand chain of a YALE Ball Bearing Spur Geared Chain Hoist—they match the power of a hundred horses!

You can't wring profits from today's highly competitive makers with haphazard methods. It takes high-geared efficiency at low-geared cost to put the black ink in your ledgers . . . the kind of efficiency that a YALE Chain Hoist and Trolley System throughout your plant will give!

Sturdy . . . Saving . . . Safe . . . YALE Chain Hoists are the lifting giants of industry. Step into almost any successful plant and you'll find them in action on all kinds of lifting jobs. Powerful profit makers —that's what they are!

Made in all types—capacities up to 40 tons—with modifications to fit your every need. Designed and built by YALE engineers to give lasting economical service, you'll find in them the answer to your heavy lifting problems.

Let a YALE Distributor show you how you, too, can give your workmen Hundred Horsepower Hands.

Capacities: 300 lbs. to 40 tons.

STEEL SAFETY HOOK

The "safety valve" of the Yale Hoist. Drop-forged from special steel, it opens slowly, without fracture, before any other part of the block is overstressed—protecting the mechanism, the load, and workman.

TOTALLY ENCLOSED—BALL BEARINGS

YALE

THE YALE & TOWNE MANUFACTURING COMPANY
PHILADELPHIA DIVISION PHILADELPHIA, PA

for **1938**

Let **"PROCUNIER"**

cut TAPPING your COSTS

INCREASE ACCURACY INCREASE PRODUCTION

with the NEW

"TRU-GRIP" TAP HOLDER

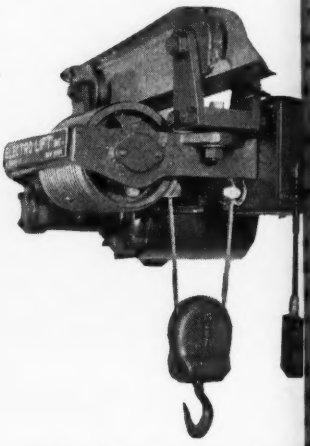
Full details gladly supplied.

Procunier Safety Chuck Co.

12 SO. CLINTON CHICAGO, ILL.

It has worm drive with worm and running on Timken tapered roller ings, fully enclosed within the ge and running in a bath of oil. Thi vides simple construction and operation. The motor has ball be and is directly attached to the frame giving compact arrangement entire load is carried on a rigid steel frame.

The hoist has close headroom al the hook to reach within a min distance of the overhead track. I a safety type hook block with a



Electro Lift Rope Guide Hoist

which completely encloses the b sheave. It is built in both Single Twin Hook types, the latter for han long loads. The control may be c rope type or push button type, the giving accurate control of the low jogging. Top and bottom limit swi may also be provided to stop the in each direction of travel, preve running the cable off the drum and viding an accurate stop at the botto well as at the top.

"Michigan" Hob Contour Che

An improved design hob co checker for every-day tool-room gear laboratory use is offered by M igan Tool Company, 7171 E. McNi Road, Detroit, Michigan. It is des for checking hobs in locating pos sources of gear errors in gear ana work. The instrument shows any d ations from true pressure angle, d to 0.0001 in. A feature of the ch

ROW MORE LIGHT ON PRODUCTION ECONOMY

WITH THE

24-HOUR SKYLIGHTS"

an save the time lost by
rs in the mere physical
f "seeing" under usual
illumination. By so doing
utomatically make pro-
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uniform high quality.
er Hewitt light can do this
or you most effectively.
a detail-revealing, restful
that makes all seeing tasks
Errors that lead to rejects
liminated and workers do
feel the common, costly
f-shift fatigue from eye-
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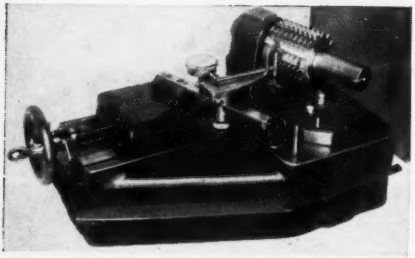
light with no increase in
ent. It will pay you to
more light on produc-
. . . with lighting engi-
ed to fit the job. General
ric Vapor Lamp Company,
Adams St., Hoboken, N. J.

In this large machine department every inch of floor space is made equally useful through the uniform high levels of illumination provided by Cooper Hewitt light. A workman is never in his own shadow. He can see details anywhere, and works without eye-fatigue throughout the entire shift.

GENERAL ELECTRIC
VAPOR LAMP COMPANY

is that it does not require interchangeable angle blocks for checking hobs of different pressure angles. To take care



Michigan Hob Contour Checker

of different pressure angles, a sine-bar setting is provided on the checker.

The indicator is provided with a multiplication of five to one, so that a movement of the contact finger of 0.0002 in. will register a travel normally representing 0.001 in. on the indicator. This enables registering even such depressions and elevations as are caused by rough grinding.

The checker is of attractive design and sturdy construction. A sheet cover is provided for protection dust when not in use.

Kwikflux

An improved, quick acting ha dering and brazing flux, Kwikflu been recently developed and is n ing marketed by Special Che Corp,. 30 Irving Place, New Yor Because of its low melting point, is below that of most hard solde on the market, Kwikflux does no the speed of brazing and hard so operations, and allows the opera perform his work as soon as the starts flowing.

The fluxing action of this flux at 212 deg. F. It has a flowing from 785 deg. to 1600 deg. F., an Because it does not evaporate a temperatures, and has a low vapo sion, maintaining its volume a temperatures, this flux can be us ciently for high melting point

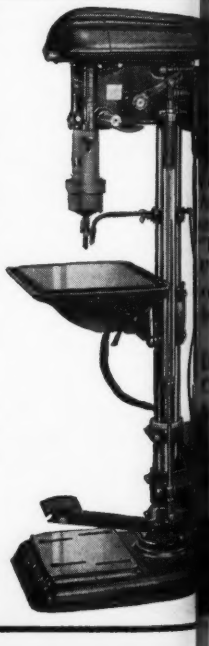
Kwikflux is for use in hard sol brazing, or welding of stainless steel, iron, copper, brass, bronze, num, silver, monel metal, German and other metals and alloys, ferr non-ferrous, or any combination o

GREATER TAPPING SPEED
INCREASED ACCURACY
UNEQUALLED FLEXIBILITY

These are but a few of the many cost-cutting advantages afforded by Procunier Universal Tapping Machines.

Five speeds ranging from 385 to 2240 R.P.M.—tap capacity from No. 8 to 5/8" with two interchangeable heads on one machine — preset feeding and backing out pressures independent of operator—automatic lubrication of taps—Procunier Sensitive High Speed Tapping Heads and Procunier Tru-Grip Tap Holder are some of the features that make possible such outstanding performance.

These and many other time-saving and cost-reducing features are fully described in the Procunier Universal Tapping Machine catalog. Write for your copy today—get the complete story of this outstanding improvement in tapping efficiency.



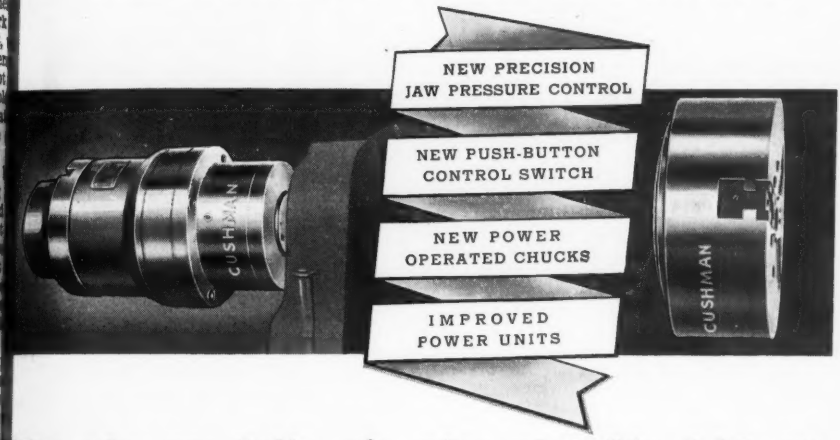
PROCUNIER SAFETY CHUCK CO.

12 S. CLINTON STREET, CHICAGO, ILL.

AGAIN CUSHMAN LEADS

with important advances in the field of

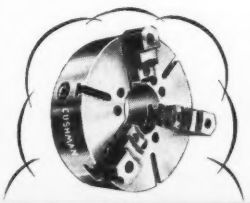
• ELECTRIC POWER CHUCKING



Where modern power chucking meth-
s are applicable, the speed, simplicity
d precision of the "Cushmatic" system
fer exceptional advantages.
It may be either push button or lever
um switch operated. The new Precision
w Pressure Control will exert whatever
w pressure is needed. The jaws will be
ositively locked during the work cycle.
t the end of the cycle, the jaws are in-
antly opened by the patented Cushman
HammerBlow" Instant Work Release.
ower consumption is negligible since cur-
ent is used only while clos-
ng and releasing the jaws.
The New Cushman Heavy
uty and Extra Heavy Duty
hucks Lever-Actuated will
e found equally adaptable
o air or hydraulic operation.
utstanding features of
ese chucks are the rug-
gedness and simplicity of their parts, completely sealed in the steel body which is a lubricant reservoir. The chuck face is a hardened steel plate doweled to the body and fastened with hollow head screws. This plate affords such a wide bearing for the jaws that wear is reduced to a minimum.

Within their rated capacity these new chucks will long maintain their high initial accuracy.

"Cushmatic" Power Chucking is applicable to all modern automatic and turret lathes. Our new Electric Chuck Bulletin Number 250 describes the equipment in detail, including price lists and full engineering data. It will bring you right up-to-date on developments in this important field.



CUSHMAN CHUCKS

A WORLD STANDARD FOR PRECISION

THE CUSHMAN CHUCK COMPANY, HARTFORD, CONNECTICUT

metals and alloys.

Its makers claim that Kwikflux cleans and floats away from the metal surface the oxides and other foreign matter present; acts as a solvent for the metal oxides formed by the action of the air; and covers the brightened metal surface to exclude air. The excess flux washes off easily from the finished work, leaving no residue, thus saving time, and cleaning expense.

Kwikflux has no adverse toxic action, and will not injure the workers' eyes, skin and respiratory mucous membranes according to the manufacturers.

The flux comes in the form of a paste which is to be mixed with water before using.

Levomatic Constant Level Oiler

Trico Fuse Mfg. Co., Milwaukee, Wis., announces a line of constant level oilers, known as the Levomatic Constant Level Oilers and available in four sizes, for automatically maintaining an accurate level of oil in ring and ball bearings of motors, line shafts, pumps, and other machinery having oil wells. As oil is consumed in the bearing chamber, it is automatically replaced with fresh oil from the reservoir.

No attention is required after t Levomatic is installed except to re the reservoir periodically. The cry clear glass reservoir is screwed to t solid bronze cadmium-plated fitti therefore, it can be removed and co

Levomatic Constant Level Oiler

veniently refilled. This feature is s to be especially valuable where install tions are in dark or inaccessible pla Levomatic Oilers are designed primari for low cost applications on small be ings.

Alco Tap Holder

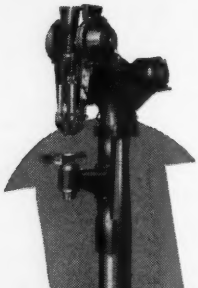
A tap holder especially designed f use on screw machines, illustrated her with, has been placed on the market b Alco Tool Company, Bridgeport, Con The tap holder is intended to simplif setting up, reduce tap breakage, an

LOW COST Production

—THE RESULT O

THIS ENGINEERING SERVIC

More and more, industry has learned that it pays t take advantage of the engineering service offered b this company. Consultation in the period of assemb design many times results in minor changes permi ting lower costs thru standardization, improv service and often economies thru multiple rivet s ting. Where this preliminary consultation is not p missible send blue print or preferably sample assemb for production study and analysis involving the use tubular or split rivets.



Complete line of automatic riveters for setting up to 4 rivets at a time.

CHICAGO RIVET & MACHINE CO

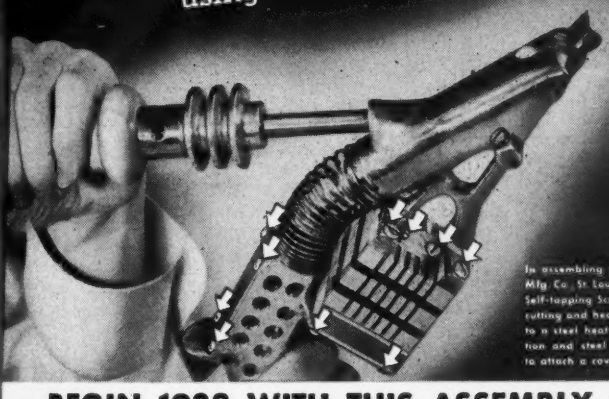
1846 S. 54th Ave., Cicero P. O., Chicago

Chicago

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF RIVETS AND RIVETING EQUIPMENT

KWICK-KUT *writes* . . .

"We have found the use of Parker-Kalon Self-Tapping Screws very profitable. They are great labor savers and they do a very satisfactory job. Our only regret is that we didn't start using them long ago."



In assembling this Tire Groover made by Kwick Kut Mfg. Co., St. Louis, Mo., sixteen Parker-Kalon Type 'Z' Self-tapping Screws are used . . . to fasten the bronze cutting and heating head and cast aluminum handle to a steel heat dissipating unit . . . to join the insulation and steel sections of heat dissipating unit . . . to attach a cover to receptacle in aluminum handle.

BEGIN 1938 WITH THIS ASSEMBLY CHECK-UP!

Call in a Parker-Kalon Assembly Engineer . . . go over metal and plastic fastening jobs with him . . . make certain you won't miss economies that Parker-Kalon Self-tapping Screws would effect.

"Our only regret is that we didn't start using them long ago" . . . says the maker of the Kwick-Kut Auto Tire Groover. Essentially the same words come from hundreds of concerns who, during the past year, invited a Parker-Kalon Assembly Engineer to show where and how Self-tapping Screws would do a better job, faster, with less labor and expense.

In 1937, more than a thousand other manufacturers who were already using this modern fastening method for certain assemblies obtained *new economies* through a check-up that disclosed overlooked opportunities for applying Parker-Kalon Self-tapping Screws.

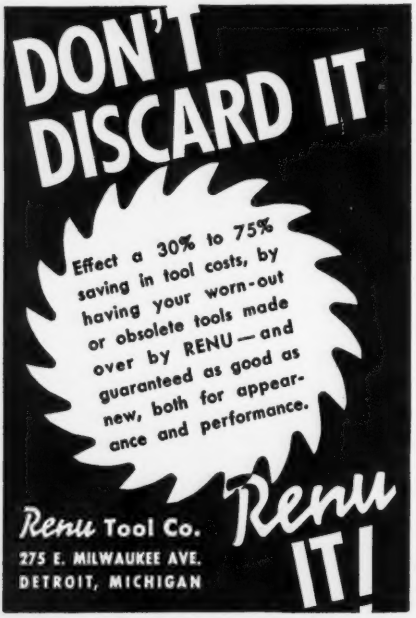
Every manufacturer whose product involves metal or plastic assembly can profitably employ the specialized knowledge of a Parker-Kalon Assembly Engineer in a study of assembly work. Records show that 7 out of 10 such studies produce notable benefits. It will pay YOU to begin 1938 by writing us to have our engineer call and make certain that you are taking full advantage of Parker-Kalon Self-tapping Screws . . . the modern means of assembly that eliminates tapping and other costly, awkward operations . . . and makes stronger fastenings, too.

PARKER-KALON CORPORATION
Dept. M, 198 Varick Street New York

PARKER-KALON *Modern* FASTENING DEVICES

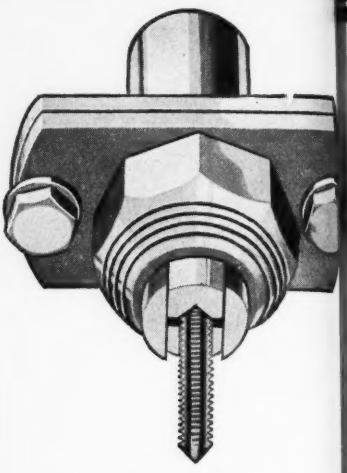
A HARDENED SELF TAPPING SCREW FOR EVERY KIND OF ASSEMBLY

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS


DON'T DISCARD IT
Effect a 30% to 75% saving in tool costs, by having your worn-out or obsolete tools made over by RENU—and guaranteed as good as new, both for appearance and performance.
Renu Tool Co.
275 E. MILWAUKEE AVE.
DETROIT, MICHIGAN
Renu IT!

eliminate necessity of bushings for ing taps. The holder is cone-shap the front end to facilitate produ It is made of high grade steel, pr hardened and ground for long wea

The construction of the holde cludes an adjustable chuck which liberal range of adjustment plus racy of concentricity. The conc alignment feature allows the tap adjusted to follow a drilled hole r less of the wear on the machine



Alco Tap Holder

would otherwise cause lack of a ment between the spindle and tur

The cone taper on the front of tool allows for clearance between tool and form tools, thereby redu time required for clearances. A com sating shank is used which allows tap to move forward when rotation the spindle is faster than the trave the screw machine cam. Inner sp actuation causes the tap to auto ically recede when the spindle is versed.

Type AA Explosion-Proof Squir Cage Motor

The Reliance Electric & Engine Company, 1088 Ivanhoe Road, Cleve Ohio, announces an explosion-p squirrel-cage alternating-current m designated as Type AA, with moun dimensions conforming to N.E.M.A. sta ards. The motor has been tested approved by The Underwriters' Lab

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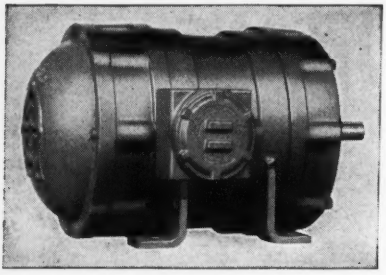
tories for Class 1 Group D hazardous locations which include those in which flammable volatile liquids, highly flammable gases, mixtures or other highly



Type AA Explosion-Proof Squirrel-Cage A.C. Motor

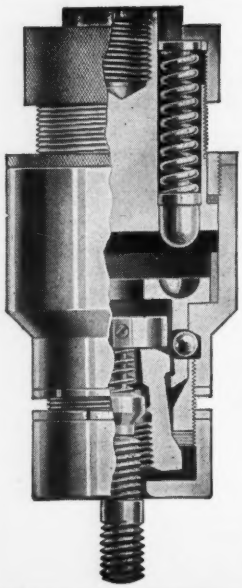
flammable substances are made, used or stored in other than the original containers.

The construction is such that all working parts are completely enclosed, and the housing is strong enough to withstand even an internal explosion without bursting, loosening the joints, or permitting flame to escape into the outside air. The rotor is integrally to assure liability and uniform of performance.

Solution for Die Lay-Out Wo

Kwick-Cote copper plate solut manufactured by Grapho Products, I 2232 Alvord St., Indianapolis, Ind., proving remarkably successful as a out fluid for die work. Kwick-Cote chemical compound that deposits a c per plating on any metal by simply d ping or painting on with a stiff br or piece of cloth. Markings made on thin layer of copper plate are long la ing, clear and distinct, making it e for the worker to follow his pattern.

Kwick-Cote was originally develo as a method of lowering costs of plati where selective hardening is necessa Hair line separation of hardness can assured with positive results. Prepa tion for hardening takes but a few mi utes as the solution is quick drying a the part can be placed in the carbur ing pots immediately. Parts treat with Kwick-Cote can be kept dead s while the rest of the piece is harden It may be used between cams, back gears, threads, in bores where stock left for reaming after heat treating, springs, and any section to be kept s



TITAN STUD SETTER

CONTROLLED DRIVE Assures Perfect Setting

The Titan Stud Setter has a safety clutch which controls driving power.

The Titan is positive in driving and automatic in releasing, thus making it possible to set the studs to any predetermined degree of tightness.

When the studs are driven to the specified tightness, the drive is automatically released and the tool may be removed without fear of mutilating or distorting the threads.

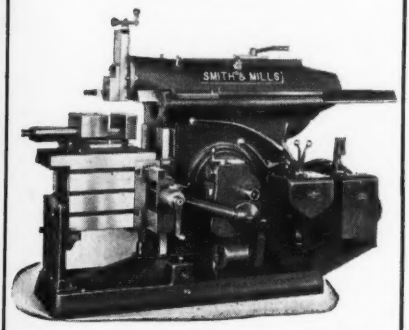
The great capacity, speed range, utility, and safety of this production tool make the Titan Stud Setter a profit-earning tool wherever it is used.

Write today for the new illustrated circular.

TITAN TOOL COMPANY

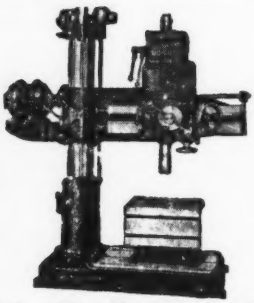
FAIRVIEW • PENNA.

SMITH & MILLS SHAPERS



Automatic lubrication—forced feed. Multiple disc clutch and brake. Quick feed changes. Direct reading feed and stroke dials. Power rapid traverse to cross feeds.

THE SMITH & MILLS CO.
CINCINNATI, OHIO



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"MOR-SPEED"
RADIAL DRILLS

FEATURE:
Rigidity — Convenience — Power — Simplicity — Low Cost.
Don't fail to investigate the "MOR-SPEED" line of Radials. Full facts on request.

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SENSATIONAL NEW DEVELOPMENT

EVANS REAMERS
SURPASS ALL.
HIGH SPEED STEEL.

No Honing.
Chrome Like Finish.

50 to 80 thousandths expansion.
Full Bearing Surface.
Perfect Alignment.
Will not chatter.
With Left and Right Spirals.
It can not fall in slots or oil grooves. Extension Pilots for line-up Work.

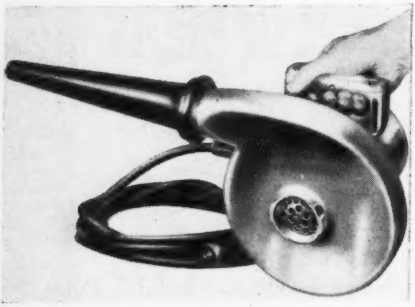
3-SPEED REAMER DRIVE

EVANS REAMING SHOP

WRITE FOR CIRCULAR
EVANS
FLEXIBLE REAMER CORP.
3656 Lincoln Ave., Chicago, Ill.

Improved "Tornado" Portable Electric Blower

The Breuer Electric Manufacturing Company, 852 Blackhawk St., Chicago,



Improved "Tornado" Portable Electric Blower

Ill., announces several changes and improvements in the "Tornado" Portable Electric Blower. The life of the motor is potentially increased through a new type of bearing construction. Miner's gauze has been placed over the intake holes in the housing to prevent damage to the motor when used under excessive dust and dirt conditions.

The added improvements, together with the many features already contained in these units, are said to make the Breuer line of portable blowers and cleaners highly efficient for the removal of dust and dirt from motors, machinery and processes in industry.

"Frosto" Air Line Freeze Preventative

An additional and improved system of air line and air tool freeze preventative known as "Frosto" is being marketed by the Sullivan Machinery Company, Michigan City, Ind., to supplement "Tanner Gas" which has proven so successful on construction, industrial and mining operations. Frosto has been developed particularly for industrial applications and wherever electric current is available for its operation. In operation, the Frosto is vaporized in a "vaporizer" and is fed into the compressed air line near the compressor as fast as necessary to prevent freezing of water vapor in the compressed air lines and air tools.

This system is very effective and economical, current consumption is small

PULLMORE CLUTCHES

Used in Partool Rotary Lathe

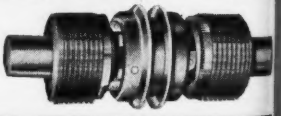
Eight No. 5 Double-type Pullmore Clutches, running in oil, transmit power to the spindles of the Partool Lathe illustrated. This lathe, designed for continuous high production, requires for each of its 8 spindles a clutch which shall be continuously reliable with a minimum of service. Pullmore Clutches meet these requirements and provide, in addition, the advantages of durability, easy operation, and economy.

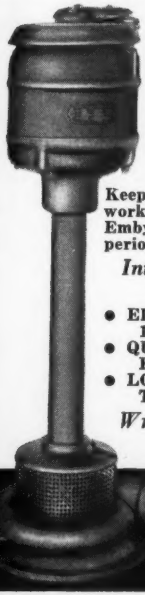
Pullmore Clutches are made in single or double types, for operation in oil or dry, in capacities up to 75 h.p. Complete information on the many sizes, the over-all dimensions and capacities of Pullmore Clutches; drawings of typical applications and illustrations of equipment using these clutches are contained in the Pullmore Blue Book, which will be sent free on request. Write for a copy, today.

ROCKFORD DRILLING MACHINE DIVISION

Borg-Warner Corporation, 300 Catherine Street, Rockford, Illinois

Sold by MORSE CHAIN CO., Ithaca, N. Y. Offices in principal cities





EMBY PUMPS

SERIES 174

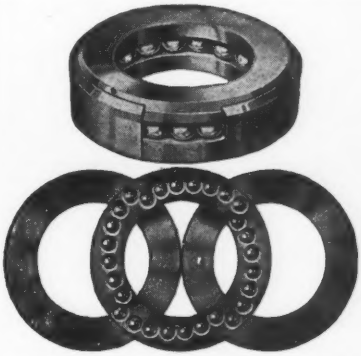
Keep expensive machines working at top efficiency with Emby Coolant Pumps of superior design.

Internal or external mounting.

- **EFFICIENT** 100% Ball Bearing
- **QUIET** Rigid—Vibrationless
- **LONG-LIVED** Top Suction

Write for descriptive folder.

NARRAGANSETT PRODUCTS CORP.
45 Baker St., Prov., R.I.



BALL THRUST BEARINGS

Special Bearings Made to Order.
Any quantity.
"One Bearing or One Thousand"

Your present bearings duplicated. Send sketch or worn sample, regardless of condition, for quotation.

Catalog Upon Request

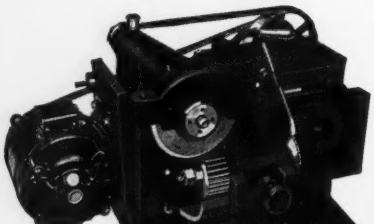
THE GWILLIAM CO.
358 Furman St., Brooklyn, N. Y.

Diamond Serrations grip tighter under less tension

SUTTON DIAMOND GRIP COLLETS

Be sure your reference file of screw machine accessories includes the complete Sutton Catalog listing DIAMOND-GRIP Collets and Feed Fingers for all machines. Copy on request.

SUTTON TOOL CO. 2842 W. Grand Blvd., Detroit, Mich.



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SHARPENER

AUTOMATICALLY SHARPENS METAL SAWS IN GANGS

Up to 5½" diameter and up to 1¾" thickness. 100 SAWS of 26 GAUGE CAN BE SHARPENED AT ONE TIME.

The saws are automatically indexed and sharpened within a variation of plus or minus .001 of exact diameter of entire lot.

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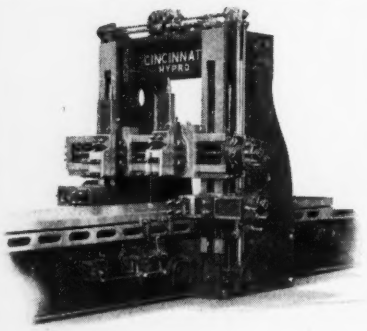


PLANERS
Double Housing, Openside
CRANK PLANERS
PLANER TYPE MILLERS
VERTICAL BORING MILLS

Write for Bulletin

THE CINCINNATI PLANER CO.
CINCINNATI • OHIO

and thermostatically controlled and on about a quart of Frosto is required t treat 100,000 cubic feet of free air un der the worst conditions of temperatu and humidity.

Babaco Automatic Signalling Equipment

To meet the need for a low cost sig nalling equipment that is suitable fo paging application in building or fac tory, the Babaco Company, 447 We 19th St., New York, N. Y., has brough

Babaco Automatic Signalling Equipment Transmitter

out a complete automatic Paging Sy tem that can be easily installed by any one.

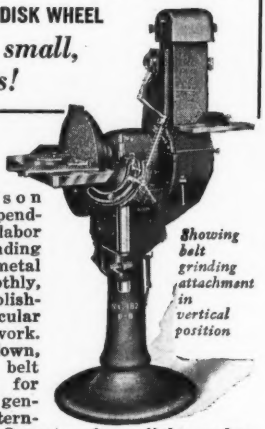
The transmitter is placed on a tele phone desk and the signal station (chimes, gongs or horns) operated there from are located where necessary, an are interconnected by means of ordin ary low voltage wire to the transmitte The transmitter can be operated fro any 110 volt AC outlet. The signal operate on 24 volt AC, which is supplie by the transmitter, without the nece sity of any accessory equipment.

Coded calls can be made to repea continuously or sound once, dependin on how the transmitter is set. The code are initiated by turning the knob on th dial to the name of the individua wanted, and then pulling it out. Belo the dial is an additional button that i pressed to sound an emergency or tim signal. The latter signal can be oper ated automatically in connection wit the time clock. It is possible to oper ate as many separate signals as may b desired; also additional gongs, chimes horns, or whistles can be added.

"Oliver" Grinder

WITH HEAVY DISK WHEEL

for those small, tough jobs!



Showing belt grinding attachment in vertical position

You'll find this Grinder doing a real job at Ford, General Electric, Hudson plants. It's a dependable time and labor saver on grinding away bits of metal quickly, smoothly, and also on polishing. Fine for circular and angular work. Table tilts 45° down, 25° up. The belt grinder is fine for straight line and general work. Patternmakers like it. Operates from light socket.

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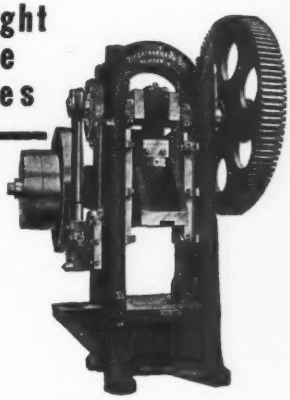
OLIVER MACHINERY COMPANY
Grand Rapids, Michigan

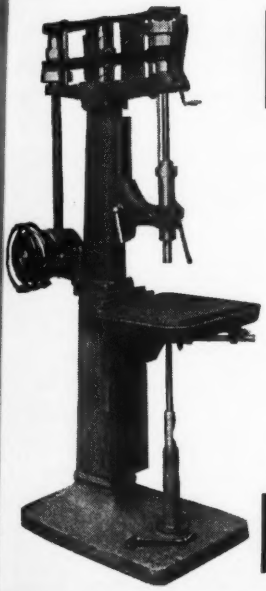
Straight side Presses



Outstanding in every detail for heavy blanking and forming work. All stresses are taken centrally.

Write for new catalog illustrating and describing this and other presses.

Zeh & Hahnemann Co.
184 Vanderpool St. Newark, N. J.



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PRECISION PLUS DEPENDABILITY

In the PROVIDENCE DRILL, PRECISION is a permanently in-built quality—not a diminishing feature. Fine design and rugged construction eliminate vibration. Ball bearings at every rotating point prevent looseness and minimize wear—at the same time increasing sensitive-ness. PRECISION in every detail of construction assures PRECISION in performance, maintained during the life of the tool. Yet—the PROVIDENCE costs little, if any, more than drills of less lasting quality. Write for the Bulletin.

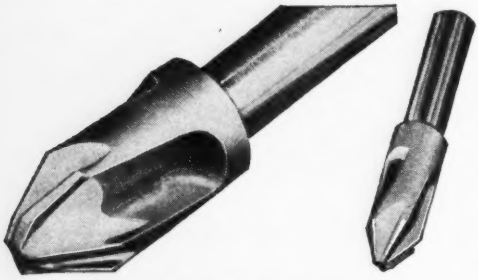
Four Models—One to Six Spindles—Belt or Motor **Drive—Hand** or Power Feed—Every Model Full Ball Bearing Throughout—For High-Speed Drilling, Boring, Reaming or Tapping.

PROVIDENCE ENGINEERING WORKS, INC.
523 So. Main Street **Providence, R. I.**

PRECISION DRILLS

Severance Chatter-less Countersink

Severance Tool Manufacturing Company, 1516 E. Genesee Ave., Saginaw, Mich., is now marketing a "Chatter-less" Countersink, designed to take heavy cuts and at the same time produce a smooth seat. The cutting teeth are so arranged as to take a "shearing" cut and thus make chatter practically impossible. The angle of the countersink teeth is 30 deg. with the center-line. The diameter at the small end is approximately one-third of the body diameter. Countersinks having 41 deg. angle can be furnished upon special order.



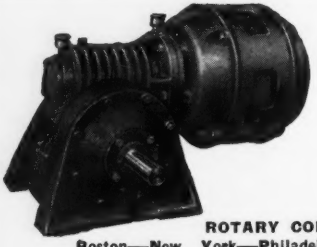
Severance Chatter-less Countersink

The tool is furnished in seven different sizes, to take cuts from ¼ to 1 in. The overall length of tool runs from 1½ to 2¾ inches.

Farrel Hydraulic Metal Forming Press

The press illustrated was built by Farrel-Birmingham Company Inc., Ansonia, Conn., for forming blanking and drawing of metal. The press is the self-contained individually-powered type, with the motor-driven pump mounted on top of the press.

The capacity of the press may be varied between 50 and 300 tons. The press has one 18-in. main ram and two double-action rams mounted in the top crosshead. The maximum working pressure is 2500 lbs. per square inch supplied by a radial piston pump driven by a 20 h.p. motor. The speed of the down-stroke is 24 in. per minute, the return traverse 32 in. per minute, and the pressing speed is 12.7 in. per minute. The press has a maximum opening of 44 in. and a maximum stroke of 18 inches.



Janette
MOTORIZED SPEED REDUCERS
A precision-built line of motorized speed reducers.
16 different types—1/20 to 7½ H.P.
A REDUCER FOR EVERY APPLICATION.
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VARIOUS WIDTHS
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BUTTS AND
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WRITE FOR PRICES
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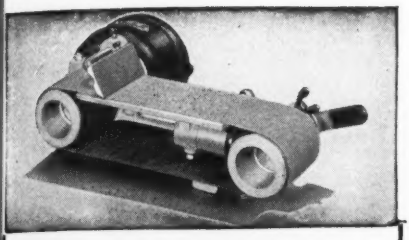


• NEW An Inexpensive ABRASIVE BAND GRINDER . . .

"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with **ALEMITE LUBRICATION** complete with grease gun.

Write for illustrated folder on this and other styles and sizes.

HORMEL-M GRINDER

WALLS SALES CORP.
96 WARREN ST. NEW YORK, N. Y.

SPECIFY ALLIGATOR

TRADE MARK

FILES . . .

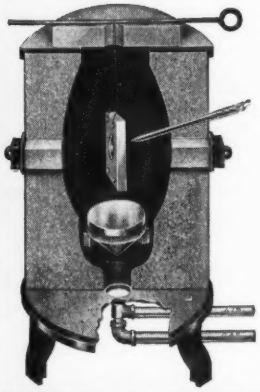
Speed up production . . . the right file for the job will save time and money. Alligator Brand Files are available in a complete line of American and Swiss Patterns in all shapes, sizes and cuts to fit every filing need. Passing the highest tests, as to shapes, cutting quality and uniform hardness, they are guaranteed perfect in every detail. Write for catalog and prices.

CARSON-NEWTON CO.

21-23 PROSPECT ST. NEWARK, N. J.

NO SCALE—NO OXIDATION—NO PITTING

For Better Heat Treating—NEW INTEROVAL



Heat straight carbon steel, Hi-Carbon, Hi-Chrome and High-Speed steels without loss in size, or danger of Pitting or oxidation. Pyrometer fire end close to work. 2400° at less time with lower fuel cost. Openings on both sides of furnace permit heat treating long parts or tools. A solid cast nickel tray is furnished which fits through these openings allowing *continuous* feeding and heat treating of small parts. Convertible into lead, cyanide or salt bath furnace accommodating 6"x12" pot.

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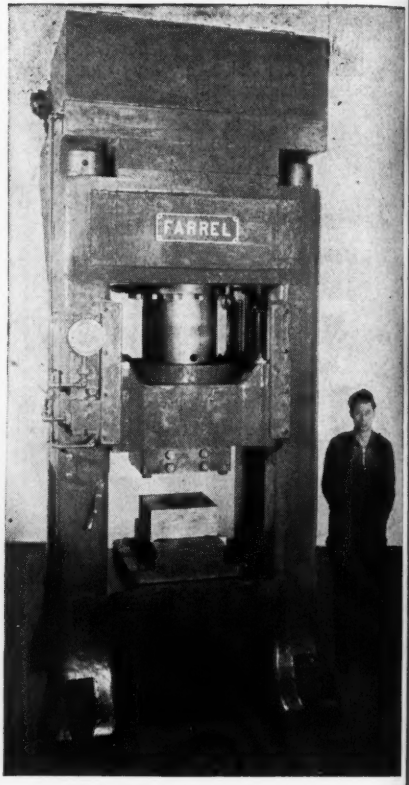
The crossheads and the frames between the top and bottom crossheads are made of Meehanite metal, a high strength, high tensile alloy iron. The tie rods are steel. The main cylinder is bronze lined. The moving crosshead is equipped with a specially adjustable knock-out. Ready adjustment of the moving crosshead guides is made possible by adjustable bronze gibs sliding against the finished interior surfaces of the press side frames.

Control of normal movements of the press is effected by a foot pedal located at the operator's left. Constant depression of this pedal causes the moving crosshead to approach the work, engage the work at the pre-set pressure and return, to again repeat the cycle. If the operator removes his foot from the



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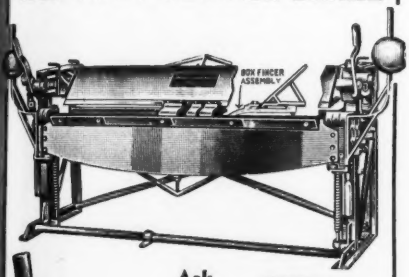

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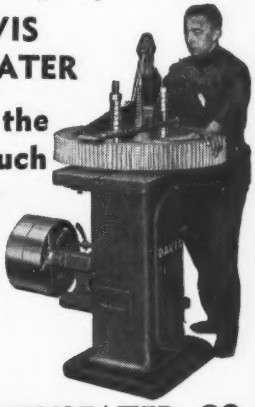

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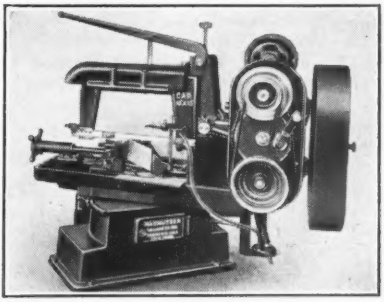

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pedal, the crosshead movement immediately stops.

For die-spotting, a hand-lever is provided at the face of the left side frame, which causes slow movement or "inching" of the moving crosshead.

M. S. A. Explosimeter

Mine Safety Appliances Company, Braddock, Thomas and Meade Sts., Pittsburgh, Pa., recently placed on the market the M. S. A. Explosimeter, a pocket-sized instrument for quickly and easily determining the presence of combustible gas hazards.

The M. S. A. Explosimeter is designed to meet the demand of operating men for an instrument that can be carried about on the job and operated by any workman. It shows whether gas concentrations are within or above the explosive range. In size and weight, the M. S. A. Explosimeter compares with a small folding camera, and can be carried either in a pocket or on a shoulder strap.

Dependability, compactness and easy operation give the Explosimeter a wide range of application. Some of the fields in which it is now being used include: Distilleries, Public Utilities, Oil Refineries, Paint and Varnish Plants, Iron and Steel Mills, Chemical By-product Plants and so on. It is especially well adapted to use by municipalities for investigating fire hazards, testing sewers, manholes and checking for gas hazards in sewage disposal plants.

M. S. A. Explosimeter

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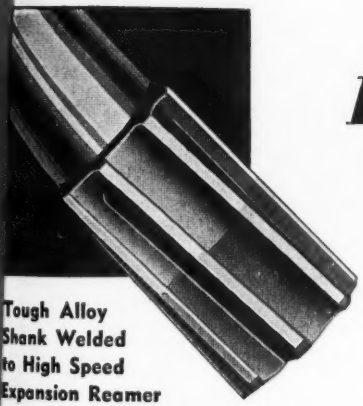

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MIDWEST *LONG LIFE* Expansion Reamers

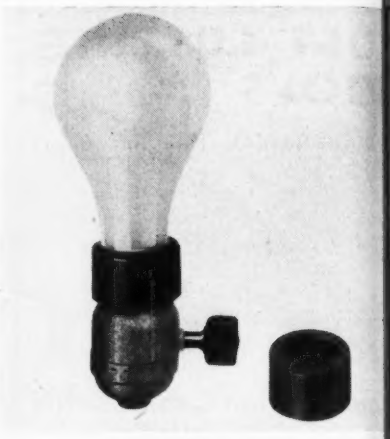
EACH expansion of a Midwest LONG LIFE Reamer represents the complete life of a solid reamer of the same size. And a Midwest Reamer can be expanded at least six times.

Midwest Reamer Circular will point the way to cutting the cost of reaming holes from ½" to 3" dia. Send for a copy.

Midwest Tool & Mfg. Company 2358 W. Jefferson Detroit, Mich.

Fostoria Socket Seal

To prevent the entrance of certain foreign particles into the space between the lamp base and the socket, The Fostoria Pressed Steel Corporation, Fostoria, Ohio, has developed the Fostoria Socket Steel Seal illustrated herewith. The seal is a molded rubber collar for medium base lamps, the seal fitting over the open end of the socket so that when the lamp bulb is inserted, the socket-lamp union is fully protected. This construction is said to prevent frequent shorts resulting from dirt, chips, grindings, cutting oils and so on which might enter the socket. The lamp end of the seal is feather-edged so that the seal fits snugly around the lamp bulb base. Fostoria Socket Seals are packed 25 to the box.

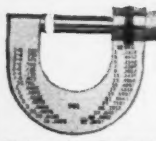


Fostoria Socket Seal

Dykem Metal Marking Colors

Dykem Metal Marking Colors for marking parts numbers, alloy numbers, names, dates, or other identification on metals have been placed on the market by The Dykem Company, 2301 North 11th St., St, Louis, Mo. The colors may be applied to metal by means of a rubber stamp or a stencil.

Dykem Metal Marking Colors contain no oil or moisture and dry in ten seconds, with a thin, tough coating which resists oil, moisture, cold and frequent handling. The colors give clear, distinct impressions, which are legible even in small type. According to the manufac-



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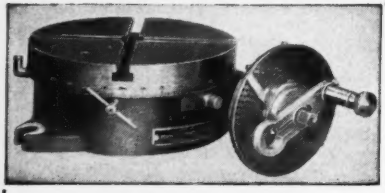

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Table graduated for single degree reading. Worm can be disengaged for turning table by hand.

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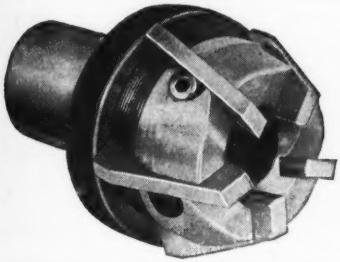

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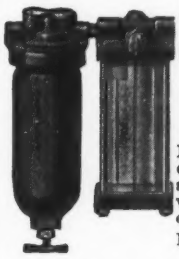

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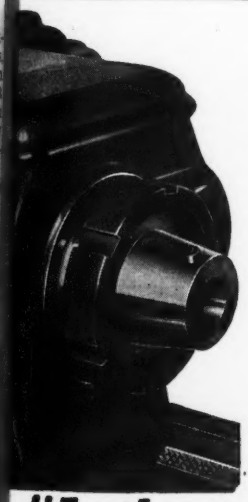

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TAPERED SPINDLE NOSE

SIDNEY has now adapted the standard tapered spindle nose as optional equipment on the Tritrol 16-speed, Sidney 12-speed and SIDNEY Precision Tool Room Lathes.

Advantages: More power — greater ease in removing face plates and chucks—brings face plate and chuck closer to the front spindle bearing.

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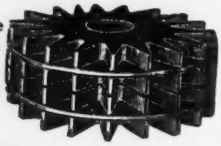
We make all types of Dressers and Cutters



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URBANA, OHIO

The Canadian Desmond-Stephan Mfg. Co., Ltd. Hamilton, Ontario, Canada

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HEAVY DUTY— Won't Burn Out

No. 800 — ½ H. P. Ball-Bearing Motor. 8"x1" wheels. 1 YEAR GUARANTEE. $48.00

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turer, even though a thin film of oil present on the object to be mark the color will penetrate the film imm diately and dry quickly on the me surface. The colors, which are harmle to all metals, can be furnished in B KR and Purple KF.

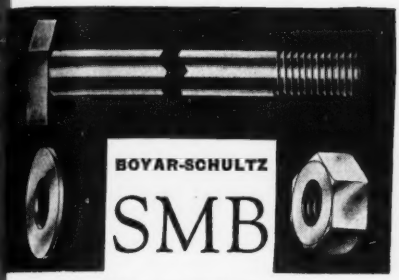
New Design in Emby Coolant Pumps

Narragansett Products Corporati 45 Baker St., Providence, R. I., has r cently incorporated in its Series 174 Emby Coolant Pumps some changes in design which increase efficiency and durability. These improvements include a new type motor unit with a redesigned motor housing. The pumps are of centrifugal type, 100% ball bearing, and are said to be unusually efficient for pumping coolant on machine tools. Their rigidity and top suction construction are also valuable features. MB Pumps, in two styles, are available for mounting inside or outside the tank and have proved highly successful in many machine shops during the past six years.

Redesigned Emby Coolant Pump

Blackman & Nuetzel Machinist Slide Rule

Blackman & Nuetzel Machinery C 3713 Washington Ave., St. Louis, Mo., now marketing a slide rule especiall designed for simplifying the calculation necessary in machine shop work. T rule is graduated so that, at one setti of the slide, the user can accurately d termine the relatively proper speed surface and rotary based on the diam eter of the work, cutter and materia also the feed per tooth, per revolutio per minute, and the total cutting tim It will also show the approximate hors power required in turning, boring, dri



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For Milling Machines, Planers and Other Tools

SAVE THE MACHINE S-M-B Bolts preserve the machine bed. Cheap bolts, with uneven heads may ruin beds on costly machines by developing warpage.

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SAVE TIME With S-M-B Bolts that are always accurate and always at hand in our Special S-M-B Bolt Racks.

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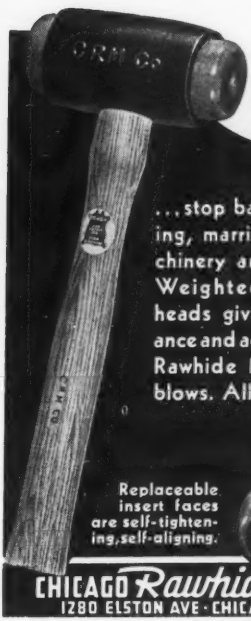

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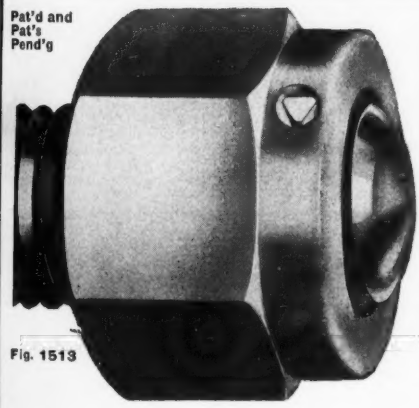

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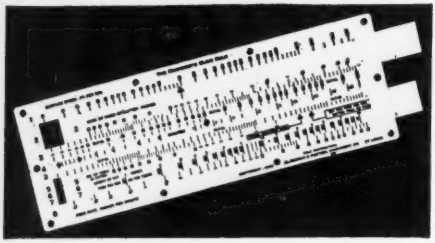
ing and milling operations, based on the cut, feed, speed and material. It also has the engineer's slide rule A and B



Blackman & Nuetzel Machinist Slide Rule

scales for ordinary mathemetical calculations. In other words, the rule is intended for quick setting of feeds and speeds, estimating power, and estimating time or production.

The rule is made with the usual slide rule celluloid faces and with smooth running face-guided slides. It is enclosed in a leather pocket case with booklet of instructions, tables and explanation. The rule is especially adapted for production and time study work.

Flintcrust

A floor maintenance material recom mended for the prevention of roug worn and broken concrete floors is n being marketed by Flexrock Compa 854 N. Delaware Ave., Philadelphia, P under the name "Flintcrust." Flin crust fills the voids or pores in the su face of concrete, thus preventing t small particles of cement and sand fr "rocking" loose. Floors treated wi Flintcrust are said to be dust-proo oil-proof, grease-proof, wear-proof, a acid resistant.

The application of this material simple. Flintcrust, dissolved in wat is flushed over a concrete floor so th it penetrates the pores, contacts the fr lime and forms a "dead" glass-like cry tal which cannot be re-dissolved. A cording to the manufacturer, the crys takes the exact shape of the void air space, and supports the surroundi particles of cement and sand, there increasing the service and efficiency be obtained from the floor, as well preserving the floor itself and preven ing the development of rough, worn a broken places. Over ordinary concre Flintcrust penetrates about 1/10 i dries quickly and fills the voids in t concrete.

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Easy and Economical with Flynn Micrometer Boring Heads.

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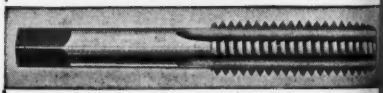

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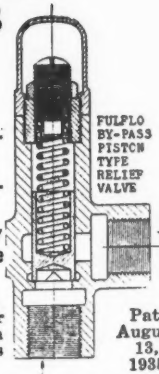
OIL BY-PASS RELIEF VALVE

- Sturdy construction
- Proven performance and Accepted by leading valve users.



Made in either bronze or cast iron with pipe sizes from ¼" to 1½".

Pat. August 13, 1935

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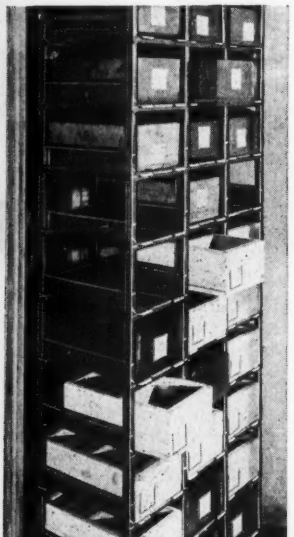
BLANCHESTER, OHIO



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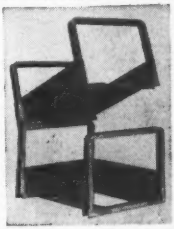
STACKRACKS are individual racks, of patented channel and formed steel construction, into which your boxes slide. The illustration on the right shows how easily they are assembled.



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53 Troy St., Providence, R. I.

I want to see how STACKRACKS can solve my storage problems. Without obligation, send me the complete story of STACKRACKS.

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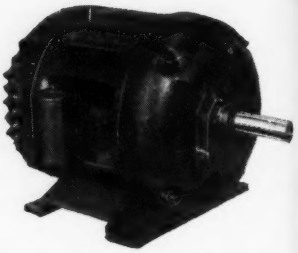
Address .....

Wagner Repulsion-Induction Single-Phase Motor

The Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., has recently developed an improved integral-horsepower repulsion-induction motor to be known as the Type RG. According to the manufacturer, the motor has electrical characteristics which make it desirable for operating air compressors, viscous liquid pumps, refrigerant compressors, conveyors, and so on. Outstanding features of the Type RG motor are high starting torque, low starting current, positive starting on low volt high power factor, and efficient ope tion.

The Wagner Type RG Repuls



Wagner Type RG Repulsion-Induction Sing Phase Motor

Induction Single-Phase Motor is avai able in three sizes from 1 to 3 h.p., both vertical and horizontal types.

Landis Four-Spindle Semi-Automatic Threading Machi

The Landis Machine Company, In Waynesboro, Penna., announces a n threading machine to supplement th present unusually complete line Thread Cutting Die Heads and Threa ing Machines.

The Quadruple Landis possesses ma distinctive features that assure accur and make it a machine of exceptio production possibilities. It will e ciently handle bolts of any length fr ¼ in. to ¾ in. in diameter. The ma mum thread length that can be cut 3½ inch.

The Four-Spindle Landis Thread Machine is of the semi-automatic ty in which the movement of the die he spindles and the opening of the grips

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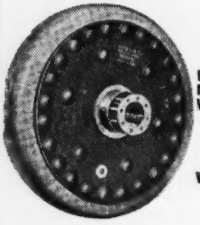

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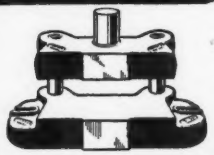

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The four die head spindles of the Quadruple Landis Threading Machine are closely coupled, making it unnecessary for the opera to move from position to pl the work in pair of grips. cycle of the chine is control from a fully closed pick-off gear box loca at the rear. gears that oper at high speeds cut from S.A.E. steel are heat treated insure maxim wearing quali All gear shaftin are bushed.

One of the m important featu of the Quadru Landis Thread Machine is method by wh the die head started on work. The die h spindle is mount on anti-fricti bearings and both a rotary sliding action its housing. forward moveme of the spindle actuated by a spring which moves die head under a heavy starting press until one or two threads are cut a which a lighter or follow up press is applied and exerted for two or th threads. The starting springs are justable to suit threads of differ pitch and various materials.

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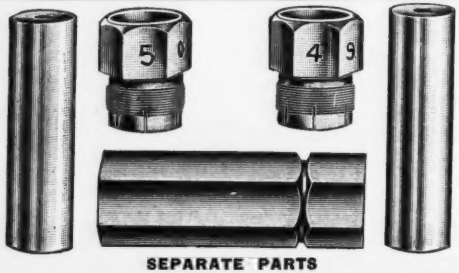

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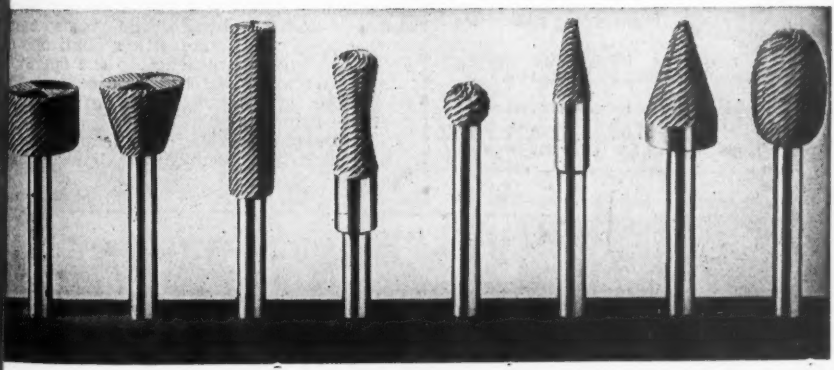

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a pad on the Gripper Jaw housing which stops the forward movement of the spindle. The stud is threaded to permit rapid and accurate adjustments for thread length.

The gripper jaws are opened by a rod and lever mechanism which is operated by the same cam that returns the die head. The grip jaws dwell in an open position a sufficient length of time to permit the operator to lay the work in the grips after which the opening pressure is removed and the grips close on the work under spring pressure. An important feature of design of the gripper mechanism is that the axis of the grip jaw is parallel to the axis of the work, ensuring perfect contact of the grips with the work.

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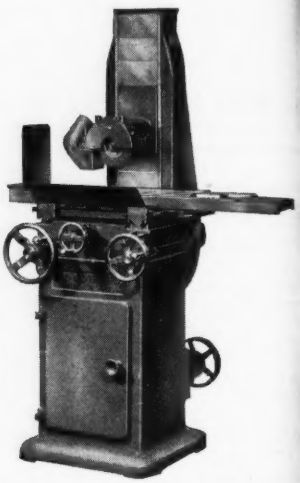
A surface grinding machine espec designed for tool room work and sl grinding operations in which the t



Reid Hand Feed No. 2 Surface Grind

of the operator is particularly requi has been brought out by Reid Broth Company, Inc., Beverly, Mass. The f ture of the machine is the centrali control with the head elevating h wheel located beside the table h wheels. This feature, other than one comfort and convenience to the opera is also one of safety inasmuch as t operator's right arm is out of the p of the spindle and wheel.

A particular effort has been made minimize the possibility of damage fr

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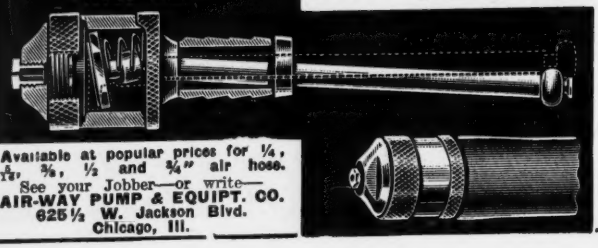

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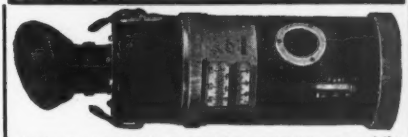

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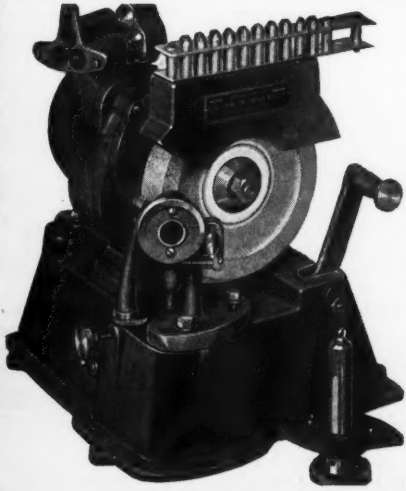

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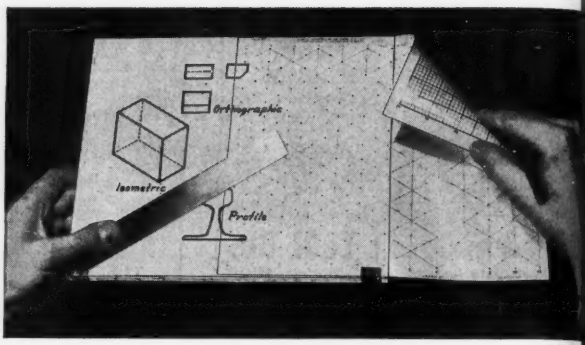
The weight of the machine has been maintained to provide a firm grinding foundation which is essential to precision work.



Wade Sketch Pad Set

Wade Sketch Pad Set

Wade Instrument Company, 1663 East 118th St., Cleveland, Ohio, is now marketing a sketch pad set intended for making any type of sketch to any scale. The set consists of a pad of strong tracing paper, and a cellulose covered buff guide plate that slides under the sheet of the pad and is printed in ink showing ⅛-in. squares, every ½ line heavy, and every 1-in. line numbered. On the other side of the guide plate is an Isometric design with three axes divided 1, ½ and ¼ in. that drawings showing all six sides of interior may be made to any scale.

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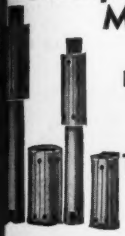

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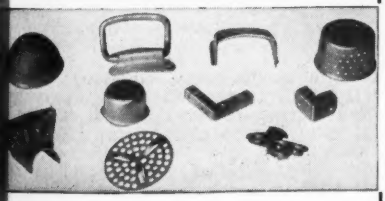

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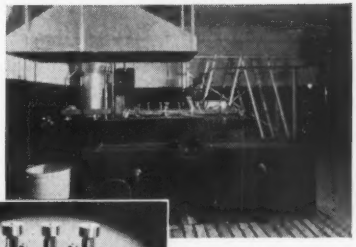

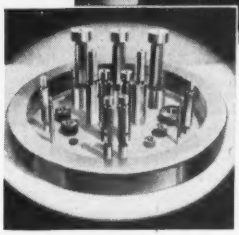

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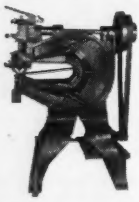

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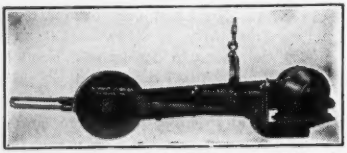

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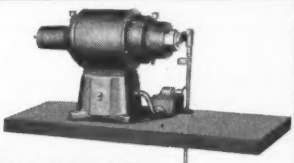

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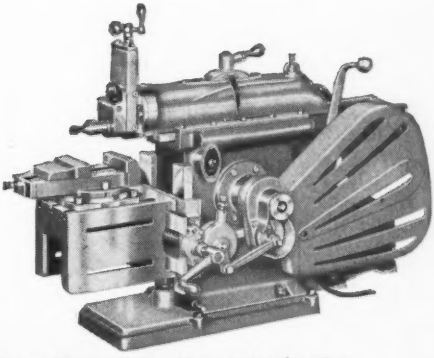

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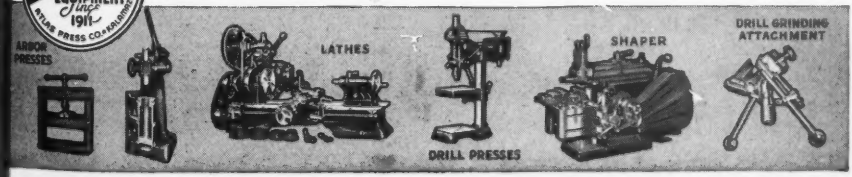

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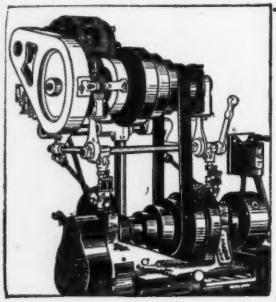

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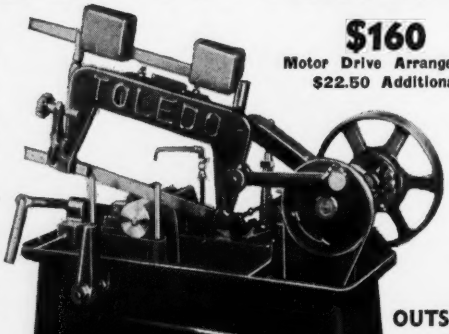

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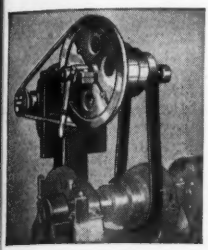

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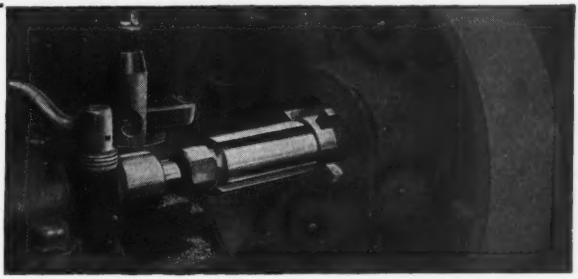
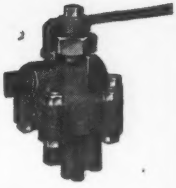


3 and 4-Way CONTROL VALVES for operating single or double acting air, steam, water or oil cylinders. Made in lever, foot, solenoid and motor operated. All pressures up to 3000 lbs. Bulletins on request.



Other Products: Arbor Presses, Flexible Couplings, Steel and Stainless Ball Floats, Steam Traps and Separators, Air Separators, Traps and Vents, etc.

W. H. NICHOLSON & CO. 136 OREGON STREET, WILKES-BARRE, PENNA.

tifully finished with a brown crackle lacquer body and heavy ornamental bead of lustrous chromium. The air-directing louver is ebony black.

Jenkins New Design Wheel, Index Plate and Disk

Users of Jenkins Standard Bronze Valves, made by Jenkins Bros., 80 White St., New York, N. Y., will have the advantages of three new developments which add convenience and better service. The new hand wheel design affords unusually large gripping area with bulkiness, and because of its deeply pressed center will prevent the h from touching a hot wheel nut.

A new valve index plate, held in depressed center of the wheel by wheel nut, gives the figure numbers the valve and the disk number and ice to aid in replacements.

A renewable composition disk is

Jenkins Bros. Depressed Center Hand W with Index Plate and Composition Di

offered with the statement that it unusually long life in steam service. is believed by Jenkins Bros. to be nearest to a universal disk that has been developed. Designated as 119-A, this disk replaces disk No. 11

Bruce Tri-Vac, Li-Vac, and Lub-V Buffing Compositions

Bruce Products Corporation, Twelfth St., Detroit, Mich., has pla a line of buffing compositions on market to be known as "Tri-Vac", base metals, "Li-Vac" for plated me and "Lub-Vac", a polishing wheel bricant. These compositions are to be made by a new method w mixes, shreds, vacuumizes or de- cools and forms the bar in one con uous operation with no interval. method gives an entirely new struc to the bar and is said to improve type of package, thus eliminating large percentage of the waste from s page, chipping, breakage and other

RIVETING?
LINLEY NOISELESS ROTARY RIVETING MACHINES
Assure Peak Production and Lower Maintenance. Rigid and Powerful Bench and Floor Types. Motor or Belt Driven. There is a Linley machine for every riveting job.
Send Samples of your Work and we will furnish accurate estimate of production and quote cost of equipment.
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AUTOMATIC
EQUIPMENT
THE V & O Press Co.
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NESTING TYPE 16 Ga. Steel
BRAND NEW TOTE PANS
20 x 12 x 6 in.
LOTS OF 50
$1.00 each
Lots of 100 and 200 less 3%, 300 up less 5%
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House ball bearings more accurately with

COMTORPLUG

The "5-question" Plug Gage

Checks holes within ½ of 1/10,000th"

Makers of precision equipment employing ball bearings have greatly improved the speed and accuracy of inspection for selective assembly. Tolerances often cut in half!

Request Bulletin No. 25

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Portable Gas

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For:
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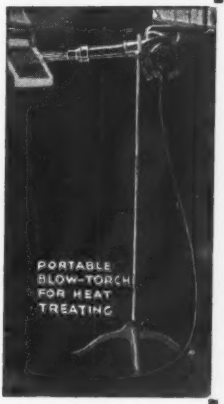
No installation costs — does away with need for concrete bases, chimneys, etc. No expensive extra equipment needed. Comes complete as shown in picture. Costs only a few cents per hour to operate. Maintains steady temperature of from 1600 to 2300 degrees as desired, mixture regulated by adjustment of air mixing valve —and gas supply cock.



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The superior performance of WINTER TAPS will insure against lost time in the production of your threaded holes —whether you have a hundred pieces to thread, or a hundred thousand.

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Here's the wonder tool that is effecting such revolutionary savings in many laboratories, model and tool rooms and on production lines. Hard-to-get-at places on machines can now be repaired without removing the part or dismantling machine.

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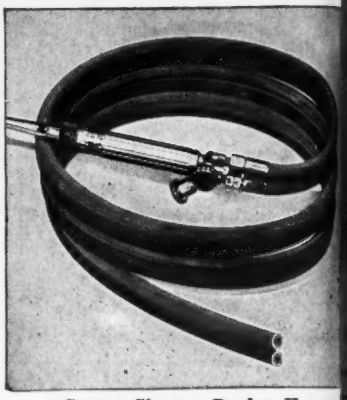
ficulties in connection with water ing.

These compositions are also sa have uniform and improved denai structure. Air pockets are said t eliminated. The new process permi almost unlimited choice in the siz shape of the bar.

Supero Siameez Duplex Ho

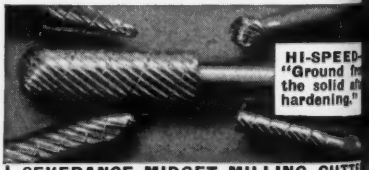
The illustration shows a rubber of radically new construction which



Supero Siameez Duplex Hose

been placed on the market by Ele Hose & Rubber Co., Wilmington, The hose is especially designed for on welding equipment and for sin services. Twin rubber tubes are sim tanecusly molded with a connecting between them so that a cross sec resembles the figure 8. A single le of this non-kinking hose is all tha necessary for equipment which he fore has required two separate tube

An additional advantage consis



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Large stock of Standard cutters. Any sh any size—custom made for burring, coun sinking, taper-reaming, tube burring and fac ball socket reaming, tripanning, etc. Sub your problem to our engineers. CATALOG ON REQUEST.

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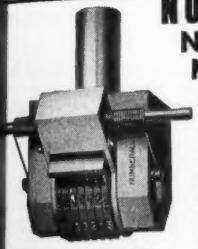

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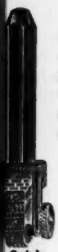
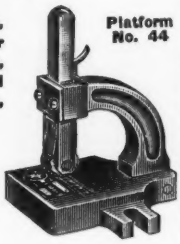
For Hand, Bench or Press use. All sizes, 1 to 10 wheels standard. Special machines built on order. FASTER than Single steel stamps or gang holders. No Type to lose.

STAMP

Name plates, steel and other metal parts, tools, metal checks, badges, etc.



Quick Change



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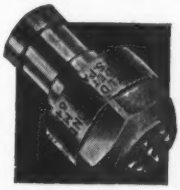
NUMBERALL STAMP & TOOL CO., Inc.
Huguenot Park, Staten Island, N. Y.



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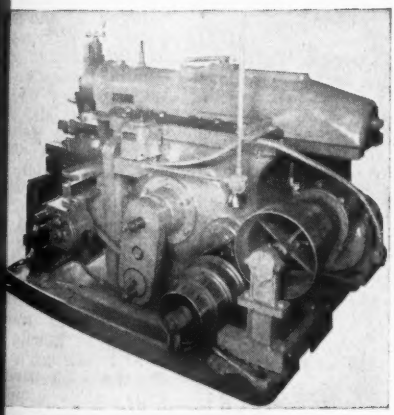

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Choose the correct type for YOUR application.

Don't judge by price alone as the lowest priced drive may not only fail to meet your full requirements, but also may prove expensive in the long run. A proper design for driving a wide range of machine tools requires consideration of many factors. To meet these requirements we offer FOUR different designs. Our sales data outlines the limitations of each type, so you can readily select the design you prefer.

Write for Form 646 which we believe you will find of definite assistance to you in motorizing your tools.

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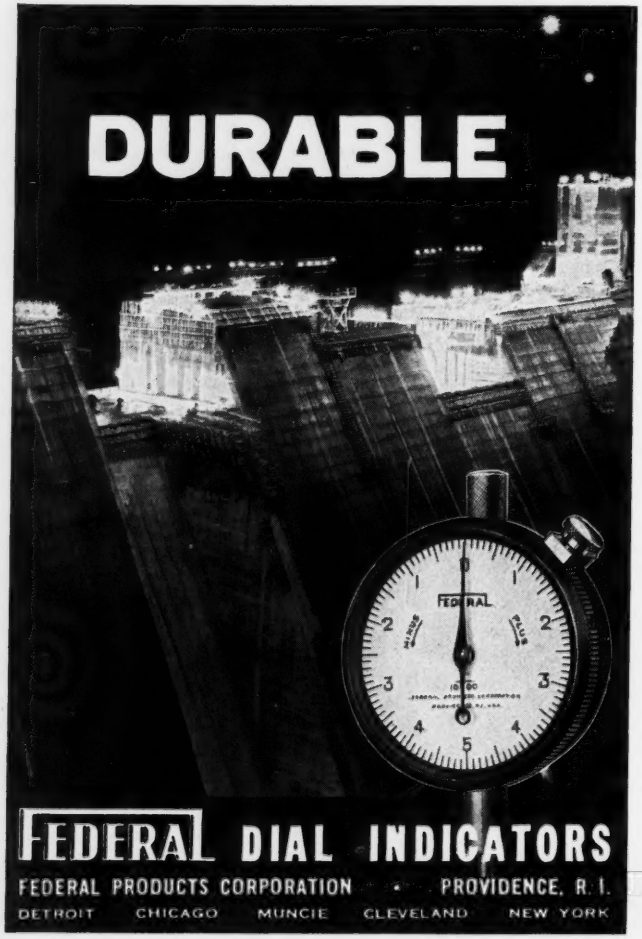
that the hose is of Supero construction with a special cord-wound reinforcement between the first and second braid, giving it a much higher burst limit than ordinary welding tubing. With the ¼-in. size, the burst limit is 2000 lbs. The Supero construction permits the use of developing pressures in each of the tubes without torque or writhing.

Supero Siameez Hose is made with the individual tubes in different colors, as red and black, or red and green, or it can be had with both lines the same color. The connecting web may be cut down to the distance required for attaching the hose to special outlets.



"Cushmatic" Electrically Operat Power Chuck

A number of improvements have b incorporated in the design and opera of the electrically operated power ch built by The Cushman Chuck Co., H ford, Conn. In this chuck the powe a specially designed, totally enclo high torque motor is transmi through a train of reducing gears t heavy bronze nut. This nut, turning either direction on a screw, develop powerful thrust or pull on the dr which actuates the jaw lever mechan of the chuck. A distinct feature of unit is the met of release, when the motor is brou up to full speed fore picking up load, thus deli ing a "hamm blow" which stantly opens chuck jaws. In e ing the chuck j this same princi of delayed pow engagement, co bined with accu control of m speed, permits p cision control of holding pressure veloped by the j

In the operat of the hammer bl mechanism, the e tact of the dri nut with the gear of the train through two ab ments, one on gear and the o on the nut. T the motor m several revoluti before engaging load and deliver blow combini both motor tor and the inertia the rotating pa Power is utili only while gripp and releasing wo pieces and in pr tice is a practic negligible cost tor.

All parts of "Cushmatic" Po unit are enclo dust-tight and ch tight. Gears are

Speed Way

A Type for Every Need

DEPENDABLE 110-volt Induction and Universal Motors (AC or DC), both encased and skeleton types, with or without built-in gear box that gives range of speeds and one of two drive shafts. Built to industrial standards. Thousands in use doing hundreds of different jobs. Remarkably low prices—on one or a million. Also low voltage motors.

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USE LAYOUT FLUID

for general machine shop and tool room use on dies, jigs, fixtures, and machined parts.

With the use of the die blue layout fluid, you do not have to polish the surface of work. Simply wipe surface fairly clean and brush on. DRIES INSTANTLY.

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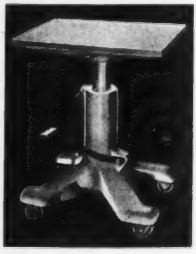

In moving heavy loads weighing up to 2000 lbs. one man can easily raise, lower or move table to required position. Table operated by sturdy hydraulic unit. No ratchets or screws to wear. 24x30 table operating between 31 and 46½ height from floor. Special sizes made to order.

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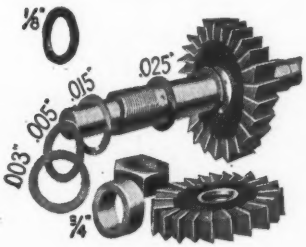

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ARBOR SPACERS

FOR quick set up of milling machine cutters, for slitters, gears, bearings. Made plain or with keyways and identification marks to order. Stock sizes .001 to .125 thickness. Special to any length, cut from bar stock, ground to decimal. Sold in bulk and also in the new, standard Cellophane, moisture-proof package offering visible inventory of spacers on hand.

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A trial assortment—enough for average use on one machine—sent for $1.00. Give arbor size when ordering.

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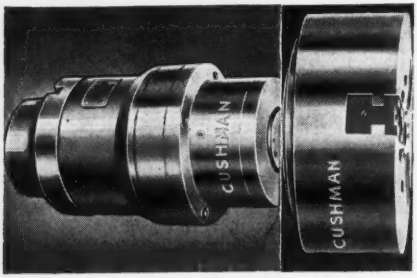
DETROIT STAMPING CO.
3449 FORT ST., WEST, DETROIT, MICH.

hardened chrome nickel steel and the abutment nut is of high tensile bronze with a screw of high carbon heat treated steel. Anti-friction ball bearings are



"Cushmatic" Electrically Operated Power Chuck

used and all moving parts operate in an oil bath. The power unit is a standard motor with special A. C. winding; 440 volts, 60 cycle, three-phase, 1800 r.p.m. By using transformer control, the motor may be operated from any circuit of three-phase, 60 cycles, regardless of whether voltage be 220, 440 or 550 volts.

ALL ALLOY **PORTABLE SHEARS**
FULLY GUARANTEED
Two Sizes

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No. 2 cuts up to ¼" steel plate.
Special Blades for shearing stainless steel.
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Davis Protective Clothing

A line of protective clothing for w ers, complete for both acetylene and work, has been added to the compre sive line of safety equipment of Davis Emergency Equipment Comp Inc., 55 Van Dam Street, New Y N. Y. The Davis line of protective cl ing for acetylene welding compri goggles, sleeves, aprons, leggings, sp and gloves. For arc welding, it inclu helmets, hand shields, sleeves, apr coats, pants, leggings, spats, and gl

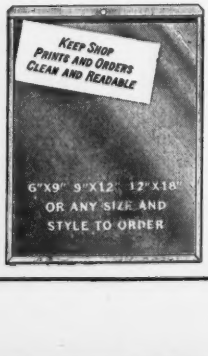
The goggles, helmets, and hand sh are equipped with glasses of var shades, each suitable for a special of work. There are five different sh of goggles, ranging in use from l brazing to heavy welding, and three ferent shades of glasses for helmets hand shields—for light and heavy tallic electrode work and for carbon work respectively.

Davis protective clothing is supp in three different materials—fire-p duck, asbestos, and chrome lea Chrome leather is, however, consid superior to the other two materials cause it remains soft under heat an much more durable. All of Davis ments are designed to give the wo maximum ease while working.

"Liquid Heat" High-Speed S Treatment Announced

A comprehensive cycle of high- steel treatment is announced by Houghton & Company, Philadelphia, in a bulletin describing new high- steel salts recently perfected by it search staff.

Together with other salt bath prod for liquid carburizing, reheating, tral hardening, tempering, and blac ing, the new high-speed steel



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GROOV-PINS are formed by pressing three longitudinal grooves into a straight pin, thereby upsetting the stock at its periphery. Driving the Groov-Pin into a drilled hole forces the upset bulges partly back into the grooves, assuring a tight fit.

Both taper and straight pins require costly and time-consuming reaming operations. Groov-Pins, however, require only a plain drilled hole.

Groov-Pins have been accepted as standard by the largest industrial concerns in the world.

PIN IT GP More than a Billion in Use

Complete information and engineering data in the Groov-Pin Bulletin. Write for it.

GROOV-PIN CORPORATION
411-413 Kerrigan Avenue
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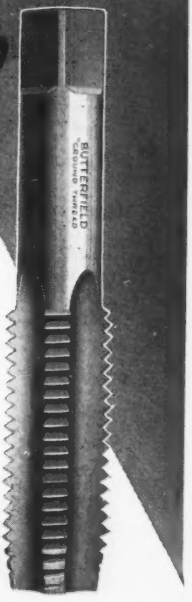
Butterfield taps



When you buy taps, you demand accurate taps that will give you long and dependable service. That's smart buying. Butterfield High Speed Steel "Commercial Ground" Taps produce "Class 2 Fit" Tolerances until entirely worn out. Order Butterfield Taps—it's smart buying.

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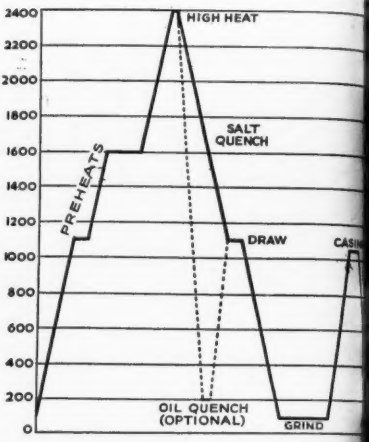
UNION TWIST DRILL CO.
BUTTERFIELD DIVISION
DERBY LINE ● VERMONT

formed an important feature of the liquid bath displays at the National Metal Exhibition in Atlantic City.

The cycle of treatment is shown in the diagram above, the products used being branded "Liquid Heat." For the preheat, a neutral hardening salt, which will neither carburize nor decarburize, is provided. Liquid Heat No. 2400 with a working range to 2500 degrees F. is recommended as a high-heat salt. Work may be quenched in oil or given a salt-bath quench following the quick high-heat treatment.



After being drawn, the work is gro and a case is super-imposed upon by a further liquid bath, recently fected, giving an outer case .001 .002 in. in depth. This additional tr ment adds a hardness of more than 000 Brinnell, and increases product of high-speed tools from 25 to 30 according to users.

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For Every Industrial Purpose

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IMPORTER
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HIGH SPEED *Shears*

For Cutting Irregular Shapes from Sheet Metal.

Meet all requirements for such work — standard equipment furnished for ring and circle cutting . . . absolutely accurate and easily operated . . . metal is sheared and not punched.

Cut anywhere, no starting holes required for inside cutting . . . only one adjustment for various thicknesses of material used . . . unobstructed cutting vision . . . no further finishing required. No special cutters, pilots, templates, or strippers are needed . . . long life shear blades. Write for complete information.

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GREEN BAY, WISCONSIN
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REAMERS
AND
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Special Reaming Problems Invited
Immediate Shipment on Stock Tools
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THE GAMMONS-HOLMAN CO. MANCHESTER, CONN.

"COMET" Internal Boring and Threading Tools

Time-saving—Increased production—Greater accuracy

Use Ready-made Tools for economy and service.

For holes from ⅛" up. 15 different sizes.

Easily resharpened. Angles always maintained.

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COMET TOOLS, INC.
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DON'T CUSS when your taps break off • • •

THE WALTON TAP EXTRACTOR will remove them easily and quickly

No longer necessary to anneal the broken tap. The steel fingers of the Extractor, inserted in the flutes of the broken tap, remove the broken piece intact. Made in all standard sizes from No. 4 to 1½".

Will you give it a 60 days free trial?

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MARK BETTER LAST LONGER

A stamp is only as good as the mark it makes.

Thor Stamps give legible markings—longer and with greater uniformity.

Thor Stamps have "blue heads"—signs that the special alloy steel is correctly heat-treated. Turned Heads — give a central striking point. Thumb Side Marking—makes them easily read, easily used.

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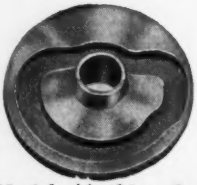

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Hand Operated
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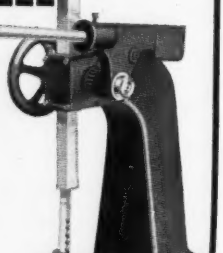

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GREENFIELD • MASS., U. S. A.

Conversion Table for Hardness on Rockwell, Brinell, Vickers, Sc scopes, Using Various Kilogram L This table, which is printed on h cardboard 3⅝x6 in. in size, gives relative values of Rockwell, Brinell

CONVERSION TABLE FOR HARDNESS TEST O ROCKWELL, BRINELL, VICKERS, SCLEROSCOP USING VARIOUS KILOGRAM LOADS

ROCKWELL			BRINELL 10 M/M Ba			
DIAMOND C SCALE			Diam. of Ball Impression In M/M	PRESSURE IN KILOGRAMS		Vickers or Firth Diamond Hardness Number
150 KGM	100 KGM	60 KGM		3000	500	
72	82	89	2.20	782	130	1220
69	80	87	2.25	744	124	1114
67	78	85	2.30	713	119	1021
65	76	84	2.35	683	114	940
63	74	83	2.40	652	109	867
61	72	82	2.45	627	105	803
59	71	81	2.50	600	100	746
58	69	80	2.55	578	96	694
56	68	79	2.60	555	93	649
54	67	78	2.65	532	89	606
52	65	77	2.70	512	86	587
51	64	76	2.75	495	83	551
49	63	76	2.80	477	80	534
48	62	75	2.85	460	77	502
47	61	74	2.90	444	74	474
45	60	73	2.95	430	73	460
44	59	73	3.00	418	70	435
43	58	72	3.05	402	67	423
41	57	71	3.10	387	65	401
40	56	71	3.15	375	63	390
39	55	70	3.20	364	61	380
38	54	69	3.25	351	59	361
37	53	69	3.30	340	57	344
36	52	68	3.35	332	55	335
35	52	68	3.40	321	54	320
34	51	67	3.45	311	52	312
33	50	67	3.50	302	50	305
31	49	66	3.55	293	49	291
30	49	66	3.60	286	48	285
29	48	65	3.65	277	46	278
28	47	65	3.70	269	45	272
27	46	64	3.75	262	44	261
26	45	64	3.80	255	43	255
25	45	63	3.85	248	41	250
24	44	63	3.90	241	40	240
23	43	62	3.95	235	39	235
22	42	62	4.00	228	38.0	226
21	41	61	4.05	223	37.0	221
20	41	61	4.10	217	36.0	217
19	40	60	4.15	212	35.0	213
18	39	60	4.20	207	34.5	209

other testing instruments based on kilogram load system. Copies ca had by addressing the Industrial mond Co., Inc., 1342 W. Vernor H way, Detroit, Michigan.

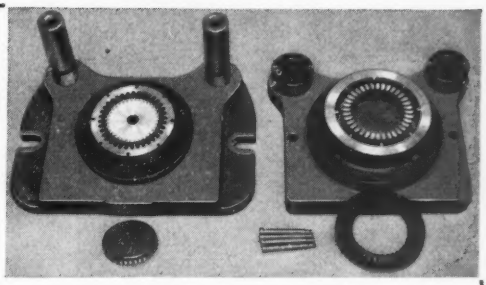
"Modern" Screw Machine Sli

The Modern Collet and Machine C pany, Ecorse, Michigan, has introduc new type screw machine slide that corporates principles of design w mark a definite forward step in construction.

Among the outstanding feature this new slide is the elimination o rocking and swaying, regardless of amount of the cut the slide must The bearing surface of the slide, be of its special eliptical design, cove

CERROMATRIX

12 lbs.
saved 50 hours



Using twelve pounds of CERROMATRIX to secure punch and die parts, The Peerless Electric Company of Warren, Ohio, saved over fifty hours tool room labor in producing this die.

They write us: "This die is used for punching 26 gauge electric sheet steel. CERROMATRIX held die parts in accurate alignment during the entire life of the die."

Perhaps you, too, can save money through the use of Cerromatrix.

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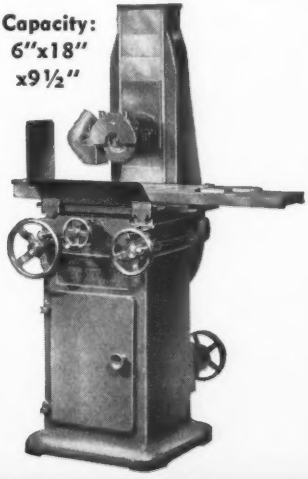

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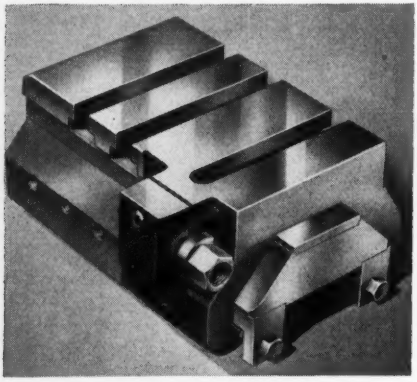

"Modern" Screw Machine Slide

least three times more surface than any other slide. Adjustments are quickly noted, and can be made easily. Once the adjustment is made, it remains securely in position. The design permits quick, simple installation.

The Modern Collet and Machine Company has now adopted this type of slide as a standard product, and at the present time carries it in stock, ready immediate delivery, for any size Gri Machine.

Correction — Unbrako Self-Lock Hollow Set Screw

In the announcement of this set sc on page 248 of the November 1937 i of MODERN MACHINE SHOP, a st ment was made that "the first appl tion is the most difficult." This tence should have read, "The first ap cation is the most efficient."

Milne Color Bar Code for Too Steel Identification

In order to simplify the task of se ing the correct grade of tool steel Milne & Co., 741 Washington St., York, N. Y., are now coloring all bars by spraying them with lacquer various colors, the color used servin an identification of the steel.

The many advantages of the M Color Bar Plan are readily apparent bar may be quickly identified, even inexperienced stock clerks, no ma how much has been cut from the

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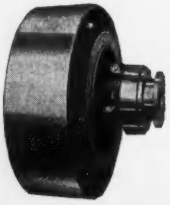

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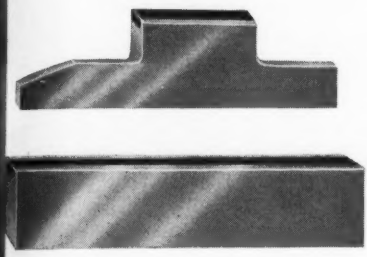

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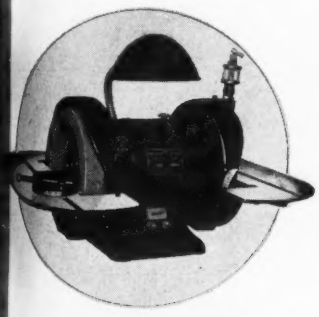

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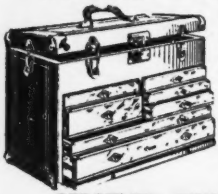

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This machine quickly stamps details and serial numbers into name plates.
Write For Particulars
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This method also precludes the p
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Everyone through whose hands
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BARS ARE SPRAYED OVER ALL
WITH IDENTIFYING COLOR
ASK FOR A DESCRIPTIVE CHART of the MILNE COLOR BAR CODE

steel delivered to him is of the co
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be used. The toolmaker is no longer
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proper selection and the heat tre
can competently follow heat treating
structions, knowing by the color of
bar that the steel is as specified.

In order to educate stockroom cl
toolmakers and heat treaters in
Milne Color Bar Code, large wall ch

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CORRECT PRINCIPLE
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HE STANDARD DIAL BORE AGE is designed to measure ametrically through the center the bore, which is the recog- zed principle for correct meas- ing.

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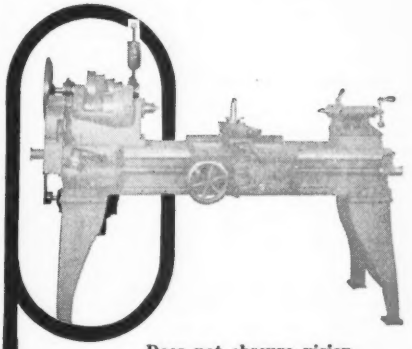
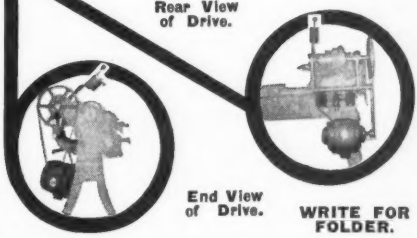
Motor Drive Attachment for Your Cone Head Lathes



Does not obscure vision.
Adaptable to any cone head countershaft lathe.
Simple—sturdy—compact.
Easy to attach.
12" size—$55. 16" size—$63. 20" size—$90.
Drum type reversing switch included in above prices.

Rear View of Drive.



End View of Drive.

WRITE FOR FOLDER.

THE SEBASTIAN LATHE CO.
CINCINNATI • OHIO

showing the actual colors used to identify the several grades of tool steel are being distributed by A. Milne & Co. Recommendations for heat treatment of each grade of steel are printed on the chart. A copy of this chart can be had by addressing A. Milne & Co. at the above address.

Jobbers and distributors of Milne Tool Steels can also obtain a framed display similar to that illustrated, for use in sales rooms or show windows. The frame is to be used with Milne spray painted sample bars, each with the name of the steel plainly stenciled on it.

Doall Announces Prize Conte

To acquaint a wider number of ma facturers and metal fabricators with astonishing savings of time and mat being secured from contour sawing filing) Continental Machine Specia Inc., Minneapolis, Minn., announc prize contest, the basis of award t unusual accomplishments through use of this new method of machin The first prize is $100, second prize with other cash and merchandise p being offered.

This Doall Users Accomplishment C test is open to individual, altho it is believed present user this equipment be the best able provide the fa regarding the ings being acc plished.

The company's nouncement of contest states, Handbook on C tour Sawing p lished early in has been mentio by many as valu in providing d regarding this s ling new fabrica method, but si the publication the Handbook have been infor of many ways which Contour chining has effe important savi not discussed in Handbook." The satility of the D machine is il trated in the nouncement of contest; some of examples being t plates 72 inch long by 22 inc deep, dinking cut from solid bl large size nick steel tools, unu "shaper" work, g cut without mil and irregular s ing of fibre a other plastics.

Details regard prizes and ru judging and ti

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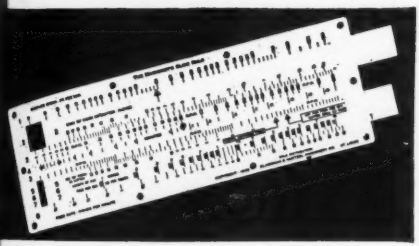
Gear Problems and IXL Speed Reducers. The complete line of equipment made by Foote Bros. Gear & Machine Corporation, 5301 S. Western Blvd., Chicago, Ill., including a wide variety of gears, worm, spur and herringbone gear speed reducers, tractor transmissions, sprockets, machine racks, friction clutches, rigid and flexible couplings, general transmission equipment and special machinery, is described and illustrated in a 664-page catalog, designated as No. 204-B. Complete specifications and prices are listed. Copy free to any mechanical executive who will address a request on his company letterhead.

Sarco Steam Hook-Up Book. The main sections of this booklet, now being issued by the Sarco Company, Inc., 183 Madison Ave., New York, N. Y., are devoted to methods for calculating trap sizes, hook-ups and descriptions of various types of heating systems (including unit heaters and air conditioning), hook-ups for process steam applications, hook-ups for steam headers, hook-ups for temperature control, and basic descriptions of the fundamental characteristics of the various types of steam



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